NATIONAL ECONOMIC DEVELOPMENT OFFICE

MANPOWER IN THE CHEMICAL INDUSTRY

A comparison of British and American practices

This report was prepared by a working party of the Economic Development Committee for the Chemical Industry

LONDON: HER MAJESTY'S STATIONERY OFFICE, 1967

Foreword

by the chairman of the Economic Development Committee for the Chemical Industry

The preparation and publication of this report, under the aegis of the Economic Development Committee for the Chemical Industry, would not have been possible without the willing co-operation of the firms whose operations were studied by the team and of the British companies and trade unions which so generously released their employees to take part in the investigation.

It will be obvious to all who read this report that the members of the team have given a great deal of their own and their employers' time to the task before, during and after the visit to North America.

The EDC *gratefully acknowledges its debt to the American, Canadian and British firms visited, to the members of the team and to their employers.*

G H Baeby

Contents

Foreword page iii

1 **Introduction** 1

2 **Summary of findings** 4

3 **Discussion of findings** 5

3.1 Major differences in practices, policies and attitudes 5

3.11 *Scale of operations* 5

3.12 *Organisation and quality of management and supervision* 6

3.13 *Profit consciousness* 8

3.14 *Demarcation and flexibility* 9

3.2 Comparison of general management practices and attitudes 11

3.21 *Cost control* 11

3.22 *Production* 13

3.23 *Techniques for determining manning* 16

3.24 *Labour-saving equipment* 17

3.25 *Instrumentation and automation* 18

3.26 *Maintenance work* 18

(*a*) *Organisation* 19

(*b*) *Reduction of maintenance costs* 20

(*c*) *Elimination of unnecessary maintenance work* 20

(*d*) *Efficiency in maintenance work* 22

3.27 *Use of contractors* 23

3.28 *Maintenance and consumable stores* 24

3.29 *Management teamwork* 25

3.3 Comparison of employment practices 26

3.31 *Recruitment and selection* 26

3.32 *Training* 28

(*a*) *General* 28

(*b*) *Process and general workers* 29

(*c*) *Maintenance men* 29
(*d*) *Foremen* 30
(*e*) *Other salaried staff* 30
3.33 *Promotion* 31
3.34 *Payment systems* 32
3.35 *Attitudes to shift-work and overtime* 34
3.4 Comparison of industrial relations practices 34
3.41 *Negotiating procedures* 34
3.42 *Identification of employees with company: company's local image* 38
3.43 *Fringe benefits* 39
3.44 *Similarity of terms of employment—staff and payroll* 39
3.45 *Working conditions and welfare* 40
3.46 *Safety* 41
3.47 *Communications and consultation* 43
4 Statistics 46
(*a*) *Comparison of overall production manning* 46
(*b*) *Comparison of overall manning on maintenance and utilities* 46
(*c*) *Clerical and administrative employees* 48
(*d*) *Other employees* 48
(*e*) *Ratios of staff to hourly-paid workers* 49
(*f*) *Comparative composition of total works employment* 49
(*g*) *Summary table* 50
(*h*) *Comparisons of national statistics* 52
5 Conclusions and recommendations 54

Appendices

A Companies visited 58
B Processes studied 59
C Team members 60
D Items covered in management/union contracts 61

1 Introduction

The Economic Development Committee for the Chemical Industry considered figures which had been assembled by its manpower sub-committee showing international comparisons of manning in the chemical industry. Some of the data came from published statistics, some from private investigations carried out by one or two of the larger companies in the fields in which they were particularly interested. These figures provided very crude measures of the efficiency with which the chemical producing countries of the west were employing their manpower. They showed that a considerable difference existed between the United States of America and Canada on the one hand and Great Britain and other European countries on the other. These figures, which dealt with nett added value and annual sales value per person employed, were so global and so crude that they gave no guide to the reasons for the discrepancy.

The Economic Development Committee recognised that certain major differences between the chemical industries on the two sides of the Atlantic such as the scale of operations, the size of indigenous market and the proportion of the output which had to be suitably packed for export, could well account for a considerable part of the difference. Nevertheless they considered that there was abundant evidence particularly from the experience of the EDC members that the manufacturers in America were able to employ their work forces more efficiently than their counterparts in Britain.

The EDC therefore decided that it would be of great value to the industry if a team, representing both management and the trade unions, were to visit North America to find out how these results were achieved and which were the principal factors leading to the better American performance. Thanks to the generous co-operation of Canadian and American companies, it proved possible to send a team to visit eight companies in North America and have detailed discussions with the managements and in most cases the representatives of the workers and trade unions. In six of the cases, the team was permitted to visit and study the works. The team left London Airport on 15 October and returned on 6 November 1966, spending three full weeks in North America.

In order better to identify the differences in practices, the team also visited between the summer of 1966 and the spring of 1967 seven British firms which made the same products by similar processes and as nearly as could be on the same scale as the North American companies concerned.

Our gratitude is due to the companies on both sides of the Atlantic who so generously assisted the team. Very considerable efforts went into the preliminary preparation of information for the team and a great deal of time and energy of senior management and other personnel was freely given.

Lists of the companies visited and the processes studied are given in Appendices *A* and *B*, and a list of the team will be found in Appendix *C*.

The team was selected by the manpower sub-committee of the EDC working in collaboration with the Chemical Industries Association. The terms of reference were to study and to report upon the methods of achieving economies in the use of manpower which are employed in North America, with particular reference to those which could usefully be adopted in the chemical industry in the United Kingdom. The team held two preliminary meetings in London, after which we produced a memorandum setting out what we were seeking to achieve. This had the dual purpose of explaining why we sought permission to visit the North American and British companies and of assuring our prospective hosts that their inner-most secrets would not be published for all to see. We also drew up a questionnaire essentially designed to collect figures showing how staff and labour force was being deployed, a list of matters we would like to discuss on location and a brief glossary.

We realised that the task that we were attempting was very complex and we decided that the most efficient way of tackling it was to divide the team into three syndicates. The first syndicate concentrated on the work of the process operators and all who supervised them. The second syndicate took responsibility for examining all aspects of plant maintenance, and the third syndicate took on the double role of investigating the whole field of industrial relations and at the same time the somewhat unrelated subject of the clerical and administrative superstructure.

Four visits in Britain before we left gave us the opportunity of settling down together as a team and modifying our questionnaire in the light of our experience. It was a happy coincidence that Maurice Crass, the secretary-treasurer of the Manufacturing Chemists Association in America, was in London during the summer of 1966, and we took the opportunity of discussing with him the papers that we were proposing to send to America and received from him valuable guidance.

For practical reasons, the time which the team was able to spend in North America was limited to three weeks and even before we left we were very dubious as to the value of the statistical comparison of British and American firms that we were attempting to make. It was therefore decided that the team would concentrate on methods rather than on the time-consuming and probably fruitless effort to obtain valid precise statistical measures of comparison.

Our fears about the difficulty of making true comparisons were well founded. In nearly every case, the size of the plant units and the annual output of the American company were larger than those of its British counterpart, sometimes very much so. By the same token, we confirmed in general terms that the extent of the American market and the size of the orders placed by the customers both made significant contributions towards reducing the numbers employed on handling goods and clerical duties.

Statistics on the number of men employed sub-divided in various ways were however collected, on the strictest understanding that they were to be treated with the utmost confidence and would not be published except in the form of global comparisons. The results of our efforts in this field are given in Section 4 (statistics).

It is necessary to make three points to qualify the findings of this report. First, in three weeks, even working at very high pressure, it was not possible to study more than a sample of the American chemical industry. This sample, including as it did, large, medium-sized and small establishments, might none-the-less be regarded as typical. The second caveat is that our travels only took us over an area bounded by Montreal in the north, North Carolina in the south and across to the Mississippi. There was evidence which came out in our discussions that certain of our conclusions, particularly in the field of educational standards, wage rates and conditions of work may not apply in less industrialised areas. The third point is that we were able to allow ourselves only two working days at each factory site and one day in each of the cases where we were visiting the head office of a company. It was our general feeling, particularly when we visited the works, that although we had a great deal of information gathered together by the end of our second day, we would have liked more time to explore some matters in greater depth and to check up any cases where there was a discrepancy of findings between the syndicates.

From the foregoing, it might be said that studies which are confined of necessity to only a handful of companies operating processes which are not strictly comparable may not provide accurately a picture of the differences between North America and Great Britain. This criticism we feel may in part be justified in the case of the statistical comparisons. This hesitation about the value of our statistics need not, however, detract from the value of the exercise in throwing light upon at least some of the attitudes and methods employed in North America which stand them in such good stead competitively. We had the opportunity of talking with senior management representatives of several leading companies whose knowledge of the operating conditions in Britain was quite extensive. It was encouraging to find that in their opinion the most important points of difference were the ones we had selected for discussion.

The British companies that we visited did not include any works of Imperial Chemical Industries Limited because that company was engaged in a similar exercise of its own. Nevertheless, we are indebted to ICI for guidance on procedure and particularly in planning our studies.

On our return to Britain, each syndicate produced a comprehensive report covering all the information that it had collected at each location both in America and in Britain and a general report gathering together their impressions on those topics which the team decided were significant. From all these papers, which contain a great deal of confidential information which cannot be published, this report was prepared.

The contents of this report, and more particularly its conclusions and recommendations are our own unanimous findings. The variety of practices and processes in the chemical industry in Britain is very great and it is clearly up to individual managements to consider our conclusions and recommendations in the light of their own particular situations.

We believe that action based upon our recommendations cannot but be of benefit to the chemical industry as a whole. We trust that its message will be not only read, marked, learned and inwardly digested but acted upon.

We did not have time before going to print to obtain the endorsement of the EDC or the chemical industry itself either on the management or the trade union side. No one other than ourselves is committed by anything which appears in this report.

2 Summary of findings

Even taking into account the necessarily limited nature of our investigations, we are confident in asserting that there is a real and disturbing difference in manpower usage as between the British chemical industry and the North American chemical industry. American output per head in the chemical industry is perhaps three times the corresponding figure for Britain. We were able to identify many differences in practices, policies and attitudes contributing to the better achievement in America.

Scale of operations, well known to be greater in American industry, appeared to account for some two-thirds of the difference in overall manning. This we accept as being a factor which cannot be modified overnight. We nevertheless recognise it as being of vital significance and therefore not to be shrugged off as being beyond our control. There are steps which can and should be taken to improve it in the long term.

We also found areas of difference where immediate action could be taken to produce significant improvements in the short term. These can all be summarised as requiring the adoption of more enlightened attitudes by all employed in the British chemical industry.

The observations leading us to these conclusions are discussed in detail in Section 3 of this report. The detailed conclusions we draw, and the actions we recommend to effect the necessary improvements, are set out in Section 5.

In respect of each of our recommendations we have clearly indicated those whose responsibility it is to take action. We cannot stress too strongly our conviction that if the British chemical industry is to occupy its rightful position in world trade the steps that we have indicated have got to be taken, and some of them have got to be taken promptly.

3 Discussion of findings

In three weeks of concentrated visits and discussions in North America we met with so many practices and attitudes which struck us as differing from their British counterparts that it was sometimes difficult for us to sort the wheat from the chaff. The differences were not always differences from what we had found in the counterpart British works which we have visited as a team. Sometimes they were differences from what our personal knowledge and experience led us to believe to be typical of British industry and the British chemical industry in general. Similarly, the differences did not invariably strike us as being in favour of the American alternative. We therefore concentrated on trying to analyse and measure those whose adoption could best help us in this country.

The differences were so numerous, and so varied in apparent significance, that for the purpose of this report we have tried to categorise them. Inevitably this has led to some overlap and duplication, but we hope that it will help in any study of the report. First we discuss in Section 3.1 the differences which we found to account for the major part of the disparity in manpower utilisation. Then in Sections 3.2, 3.3 and 3.4 we discuss those areas where we found differences which although individually of less impact, nevertheless build up the background against which the main features have to be viewed.

3.1 Major differences in practices, policies and attitudes

3.11 Scale of operations

A very significant difference between the chemical industries of Britain and America is in the scale of operations. When consideration was given to selecting companies to be visited we tried to eliminate this aspect by finding pairs of companies with similar outputs of the products to be studied. This would have simplified the problem of making comparisons and identifying the differences between American and British practices. It proved to be impossible for practical purposes to find completely matched pairs and in four of the seven processes which we were able to study the output of the American company was between three and six times the output of the British counterpart: in the other three cases the output figures were approximately equal.

The most important scale factor is the size of the individual unit of production, and here the American firms scored heavily. We found in nearly all cases that the basic unit of production was considerably larger than the corresponding unit in the British company, in one case five times as large. This factor clearly has a very considerable effect on such crude measures of comparison as output per head.

This fact that 'increased productivity depends not upon jumbo works but upon jumbo plants', is best exemplified by the situation at one works we visited. A plant built in 1963 was shortly to be 'mothballed' and replaced by one three times as large, which would take no more men to run and no more men to maintain.

The size of the American market gives scope for increasing the scale of total output; this is significant in that it provides opportunity for the use of the latest bulk handling techniques and equipment; we noticed several impressive examples of this. At one company road tankers of 3,500 US gallon capacity were filled with acid in eight minutes. In another instance where a product was despatched in bags we noted a highly automated bagging and loading plant which loaded bags at the rate of twelve per minute directly into giant lorries; clearly full advantage can be taken of such a system only when there is sufficient demand for large despatches to individual destinations to justify the cost of the equipment.

It should also be noted that it is permissible in America to use far larger road tankers than are allowed under British law. Some of the barges and railway trucks in use were enormous by our standards.

Generally a much larger proportion of the output of the plants that we saw in America left the plant in bulk containers; there was therefore correspondingly less need for men to be employed on filling bags and drums. One contributory factor was that a much lower proportion of output was exported and it is in the field of exports where the problem of coping with a variety of systems of packaging to meet the requirements of individual customers becomes most marked. Another was the practice which we met more than once of despatching goods in tank cars to regional depots where the product was transferred to drums for local distribution to small customers. This practice did not produce manpower savings, since the packing was simply transferred to another site. There may have been advantages in simplifying the operation where the product was made, and in siting the depots in areas where labour was in good supply, but the main purpose was to achieve reductions in transport costs by taking advantage of the structure of freight rates; this is possible when goods have to be sent great distances.

In a similar way raw materials were in general received in much bigger containers, and where they did come in bags they were usually fully palletised and readily bandled in large quantities.

Clearly there is a considerable saving in paperwork when shipments both into and out of the works are large and there will be a corresponding reduction in the number of clerks required on the accounts, purchasing and sales departments.

We estimate that in the sample of the chemical industries of America and Britain which we were able to study, some two-thirds of the difference in total manning was a direct result of scale. It is likely that for the industries as a whole the effect of scale is even greater.

3.12 Organisation and quality of management and supervision

We were impressed by the general level of quality and effectiveness of the managements we met in America. The best management in Britain stands up to comparison with the Americans, but the average falls well short. Reasons for the higher level in America are no doubt many and various but the factor which is probably most important is the much clearer definition of management objectives. This clarity of definition facilitates the delegation as far down the line as possible of acceptable and/or manageable portions of responsibility and the necessary authority. This we consider to be a very important point: the men we met knew exactly what they were expected to do, and how to do it, and they got on with it.

The application of this principle to the management structures resulted in each organisation being tailor-made to fit the circumstances. We found no standard pattern which could be illustrated by appending a typical organisation chart. We did, however, find that the clear definition of line and specialist responsibilities produced a numerically small line organisation supported by relatively large numbers of functional staff. This can be exemplified by one sizeable production unit where of twelve superintendents reporting directly to the works manager, only five had line responsibility for production. Line management had absolute responsibility for seeing that the job was done and done well and part of this responsibility was to make full use of the functional staff who were there to be called upon for advice. In appropriate cases the functional staffs were not simply advisory but had authority to initiate action, or the complete responsibility for certain supporting activities, such as the planning and scheduling of despatches and raw material deliveries, or even, in consultation with line management, process improvement studies. The complementary role of functional departments did not seem to diminish job satisfaction and the staffs appeared eager to serve to the best of their ability, and sought opportunities to extend their grasp of the detail. For example at one plant the departmental cost accountants, whose duties were to provide cost information as early as possible, wanted to work as relief operators so that they could better understand the process they serviced. It is vital to the success of the system that the various sections of management should co-operate fully and that advice should be freely sought and willingly accepted. Our impression was that the system operated very well and the people concerned got along together extremely well.

In addition to the supporting functional staffs at works level there were usually similar departments at divisional and company level. These departments were there to give advice and not to issue orders, the decision to accept the advice being always the responsibility of the line management. In practice the advice offered is probably accepted in the vast majority of cases, partly because of the generally accepted specialisation of management and partly because the responsibility for failure as a result of ignoring advice would be great. In connection with this point about responsibility for failure it should be noted that managers have less security than the hourly paid men; the men have the protection afforded by the seniority provisions in the contract, but the management are judged on performance.

Management was regarded as a combination of 'team work' and individual responsibility. A good example of this occurred when a lay-off was decided by the line management team together with the personnel manager. The timing of the lay-off and decision as to which men were to be laid off were entirely the responsibility of one specific manager. The objective was planned by the team, its execution was the responsibility of one man. This team approach to management was evident not only in formal activities, but also informally as in the case of the works manager who met his staff once a month outside normal working hours to discuss problems and future developments.

A major advantage of the system of management specialisation, coupled with accurate definition of the areas of responsibility and objectives, was that it enabled the company to deploy its men far more accurately in accordance with their talents. Square pegs could be assigned to square holes. At all levels of management the aim was to free men from irksome and time-consuming jobs for which they have probably not been trained so that they could concentrate upon their main function. Managers were there to manage, not to waste their time and talents on simple clerical work.

The simplest example of this is probably the foreman. Foremen are normally chosen for their qualities of leadership, or 'man management' but an analysis of the work they are required to do in Britain would show that much of their time is spent on paperwork and other matters not requiring these qualities. In America clerical assistance was usually provided for foremen and it was normal also for considerable assistance to be given to them in the areas of planning and work preparation. American foremen were therefore able to devote most of their time to supervision, and training their men.

American foremen generally had a more important place in the organisation, with a greater degree of authority and responsibility. Their positions were reinforced by the fact that they spent more time with their men and also acted as a direct link in the communications between management and men. It was common for foremen to take part in the preparation of annual budgets and bear the responsibility for controlling and reducing costs in their own areas.

An outstanding feature of the American chemical industry was that there were no assistant foremen and no charge-hands. This was possible partly because the foremen were able to spend more time with their men, but more importantly because the operatives were willing to accept the responsibility for their own work. If a problem arose they tackled it, and did not seek help unless it was absolutely necessary.

In some cases there was no direct supervision of shift operatives during the 'silent' hours; one foreman or shift superintendent would be responsible for the entire site.

3.13 Profit-consciousness

Absolutely central to the American theory of business management is a highly developed profit-consciousness. We found this at all levels even on a small works where no formal cost control procedures were employed on the site. To some extent this awareness of the importance of cutting costs or increasing profits may be a national characteristic, but there is little doubt that the system of defining management objectives in terms of hard cash and studying management performance by means of accurate comparison of actual achievements with the targets set fosters this approach. Information on costs was much more freely and quickly available than is general in this country. Little cost information was received by the hourly-paid workers although they were usually aware of matters such as the costs of material wastages and the cost of a plant's being out of commission.

We use the term profit-consciousness rather than cost-consciousness to bring out the essential feature that it is the final outcome of any decision, its effect on the company's profits, which was taken into account. Great care was taken to avoid false economies such as arise when sectional interests are allowed to take precedence over the interests of the company as a whole. To this end the production manager was sometimes responsible for maintenance costs as well as production costs, and the loss of production might be taken into account in the maintenance budget. One of the best examples of the application of this principle of maximising profits occurred in a plant where the production manager was not responsible for the maintenance budget. In this particular plant a production planning department kept under continuous review the relationship between production, sales and stocks of the various products and produced a ranking list of priority for production. At the bottom of the list would be products where an interruption to production would not affect the customer because demands could be met from stock; next on the list would be those products for which it would be possible to meet orders by buying-in from other manufacturers; at the top of the list would be products where an interruption to production would cause customer dissatisfaction, by making it impossible to meet orders. This list was used by the maintenance department to determine the order in which maintenance work should be tackled.

3.14 Demarcation and flexibility

Two important features of the American chemical industry were:

1 A complete absence of 'mates' in the traditional British sense. Any assistance which was required by craftsmen was rendered by other craftsmen, trainee craftsmen or operators, according to circumstances.

2 A much greater flexibility between craftsmen and between craftsmen and process operators.

There was a great variation between works in the degree of flexibility and the systems of flexibility which were operated. Larger sites tended to be less flexible. We found one works where flexibility was non-existent and another where there was complete integration. The complete integration occurred in a very small plant and was not considered normal; it is doubtful whether such a system could be operated successfully in a larger plant.

Flexibility was generally greater than is the practice in Britain; it was however often the subject of hard, even bitter, bargaining between company and union. In some instances flexibility had been achieved or even maintained only by the management's facing a strike lasting several months and keeping production going during that time themselves; it was stated that the opportunity thus afforded the staff of operating the works also gave management a much clearer picture of the manning needs and enabled economies to be made.

The impression we formed was that there were building up amongst American workers a greater resistance to change in working procedures and a greater emphasis on job demarcation. One factor which might have contributed to this is that in the negotiations on the management/union contract, management have focussed attention on job enlargement. It was certainly the case that most of the grievances which were raised through the grievance committee procedure represented protests against an increase in flexibility, and most of the leading figures on grievance committees were men from the maintenance side, where demarcation problems generally arise.

We met the following different examples of flexibility:

1 Process operators had jobs wider in scope than their counterparts in this country. This no doubt resulted from better loading of their work but, even so, they never at any time seemed hard-pressed. In most cases operators did routine control testing and first-aid maintenance (pulling up pipe flanges, pump glands, *etc*) and were issued with a kit of minor tools. Coupled with the fact that operators tended to have more responsibility than in Britain, this appeared to result in a greater job interest and personal satisfaction.

One particularly good example of flexibility on the process side which we met was a tank car loader. This man not only loaded the tank car with a hazardous chemical, he operated the diesel driven shunter to move the cars, inspected and painted the insides of the tanks, and changed, and even overhauled, the valves. All these operations were carried out with a minimum of supervision; in fact the management considered the job to be relatively unskilled and to require only a week or so of training.

2 Craftsmen were permitted to do 'associated work'. The principle of 'associated work' is that a craftsman can do work of another craft provided he has the necessary skill, the work is associated with the job he is doing, and is not greater than 20% or 25% of the total time on that particular job. This freedom to do work of another craft did not normally cover electrical work above the level of, say, changing fuses. In one instance craftsmen in the mechanical trades could not do electrical or instrument work, and electricians and instrument mechanics could work in each other's trade but not do work in the mechanical trades.

3 We found a category of 'shift mechanics' who were allowed to do work in all trades during silent hours, subject to their possessing the necessary ability, but reverted to their basic trade during normal hours. They received extra payment during the periods when flexibility was permitted.

4 In one works we found 'plant mechanics' who were under the control of the process foremen. These were recruited from the ranks of experienced operators, and were paid the lowest trade rate. They received a very cursory training and were permitted to carry out mechanical jobs up to four hours' duration. Their value lay in their experience and knowledge of the section of the plant in which they worked.

5 In another works we found a small group of 'multi-trade journeymen'. These are qualified craftsmen who have applied and been selected on ability and have then been trained for six months on each of several other trades. The company chooses a man from the basic trade which the particular vacancy is likely principally to involve. The job is sought after, leading as it does to the possibility of staff positions or dealing with outside customers. At the present time these men are employed only in the research department.

6 Men who were training to become craftsmen (usually referred to as 'helpers' or 'apprentices') were in almost all cases expected to use the tools of their craft, and were frequently provided with their own tools. In one instance the union contract provided for the helpers to use tools but in practice this did not happen. In one works, helpers who had reached a certain standard were permitted to work on their own, and even to guide less skilled helpers, but in general helpers were supposed to work under the supervision of a fully-qualified craftsman.

7 On the maintenance side, 'mixed-trade' groups worked under the supervision of a foreman, usually of the trade which was principally involved, without the need for reference to other specialist trade foremen. Similarly craftsmen sometimes operated under the direction of a production foreman.

All these degrees and varieties of flexibility were very carefully defined in the agreement between the union and the company and were the subject of pressure by the union when any infringements were made. In one instance the union contract stated that 'associated work' could be done but the system was not operated in practice. The management had however recently made progress towards flexibility by a combination of bargaining with those crafts which were prepared to do so and taking the dispute to arbitration when agreement could not be reached.

One of our American hosts who was familiar with the situation in Britain gave it as his opinion that the introduction of British practices of demarcation between trades and between tradesmen and general workers would make it necessary to increase their work-force by 20%.

There was no rule to prohibit a craftsman from learning another trade, but he would lose seniority in the job every time he changed. It is normally possible to start training in a trade at ages up to 40 and sometimes 45. These matters are dealt with more fully in the section on training.

It is interesting to note that on the management side, particularly on the functional departments, there is a tendency towards more and more specialisation in the different scientific techniques whereas amongst the hourly paid management are seeking greater flexibility. This is not inconsistent; both can be regarded as attempts to move towards the most efficient compromise between the flexibility of the all-rounder and the skill of the specialist; in the past management has leaned too far one way and the hourly paid too far the other.

3.2 Comparison of general management practices and attitudes

3.21 Cost control

We were very impressed by the way in which the American companies we visited appeared to have developed their cost control procedures and practices to a much more effective level than their British counterparts.

There was little that was novel about the systems and procedures used. Control was exercised against annual budgets which, in the case of manufacturing costs, were translated into standard unit costs on either a variable or direct cost basis. In some cases the budgets used were flexible budgets, the detailed technique varying from place to place. These budgets did not represent a purely formal office system devised and operated by accountants, but were usually prepared, reviewed and interpreted by a cross-section of management.

This point cannot be over-emphasised. We came across numerous examples of where a thorough and systematic examination of an operation had taken place, and every aspect from raw materials to final packages had been gone through with a fine toothcomb to see how by better operation, by further capital investment, or by a better deployment of the work force, lower costs could be achieved. Targets for cost improvement were set for, and accepted by, line management from the foreman upwards, in conjunction with the technical support groups, and their validity checked by the cost department. The achievement of these targets was an immense source of job satisfaction to all who had participated.

It was not unusual for there to be a formal budget committee consisting of representatives of the production, accounting and service functions. We were impressed by the fact that many companies used these budgets to assess, and impress upon all managers, the cost of idle plant time. Use was also made of them to assess the profitability differentials between the various possible courses of action. It was probably this opportunity-costing use of budgets and standard costs which represented the main difference between cost control procedures in America and Great Britain.

It must be emphasised that the purpose of producing cost information is to give it to the line management to assist them in decision making. Also, budgetary control and standard costing systems have little effect in controlling costs unless they are designed to fit the delegation of responsibility within the organisation.

As has already been remarked in Section 3.12 (Organisation and quality of management) we found that objectives were more clearly defined and responsibility more clearly delegated in America. Right down to the level of foreman, members of management had their own carefully prepared budgets and were, in most cases, acutely aware of the cost standards to which they were expected to operate. They also seemed generally to be aware of the broader context within which those cost standards applied. For instance, maintenance engineers seemed much more aware than their British counterparts of the loss-of-profit cost of break-down time. Junior levels of management were encouraged to think continually in terms of cost reduction.

One practical device we saw in this first line attack on costs particularly impressed us. This was the use of area accounting teams working in the production area offices of two of the factories we visited. Admittedly one of these was a very large total factory, but in the other case each area accounting team corresponded to a total employee strength of about 250. Although these area accounting teams were part of the organisation of the accountancy function, they worked hand in glove with the area production managers and technologists, and in some cases spent as much as 80% of their time, on their own initiative or at the initiative of the area production management, on cost investigation and cost reduction exercises.

The main advantages of this system are clear. There is the fact that staffs separate from the line management are working on the problem of reducing costs, so that this important subject is not overlooked. Also the men doing this work are specialists and able to contribute to a full consideration of the consequences of any change upon other departments or other sections of the process. Thus there is less danger of false economies, such as the achievement of a minor improvement in chemical yield which causes a fall in output which more than offsets the yield gain expressed in terms of profits.

The general pattern was for each accounting team to be headed by a well-qualified man, such as a business administration graduate, supported by four or five cost accountants and trainee cost accountants. On one location, where it was the policy to move these area accountants around from time to time to emphasise their primary loyalty to the accountancy function, it was claimed that this experience produced men whose effectiveness in corporate accountancy posts at later stages in their careers was well above average.

The delegation of cost control responsibility to the lowest possible level was also exemplified by the factory which held each area production superintendent accountable for the return on the capital invested in his area. It was admitted that some of the measurements used in arriving at this return on capital were arbitrary, but it was claimed to be effective in instilling profit-consciousness into the level of management best placed to influence the bulk of costs.

Another example of the efforts to reduce costs was the existence of effective and resourceful purchasing departments which practised value analysis. They studied all items, which were purchased in sufficient quantity, in relation to the job they were required to do, and in conjunction with the department using them, and made sure that the company was not buying an unnecessarily elaborate product or one of too high a quality. Having established what was the minimum requirement they looked for the cheapest supply of a satisfactory article.

In most cases it was recognised that maintenance is one of the most controllable areas of cost, and the costing procedures were correspondingly elaborate. Rules for the authorisation of maintenance expenditure were, in the majority of cases, clearly defined, as were also the limits of expenditure which could be authorised by managers at various levels. These limits were low by British standards and were sometimes reduced drastically for work which was regarded as non-essential, such as minor modifications. It was not uncommon for maintenance jobs above a certain size (*eg* 8 hours work) to be pre-costed before authority was given for the work to proceed (see 3.26).

Most of the basic data used in these cost control procedures was, in the majority of the American companies, processed by computer. This in some cases resulted in faster feed-back of information about actual costs by comparison with standards or budgets. However, in most cases day-to-day control was exercised mainly on a local basis (*eg* by the plant area manager) by the use of non-financial data such as yield percentages or man-hours or tonnages, and sometimes by the use of estimated approximate costs. In the area of maintenance it was not unusual to find a daily report of man-hours worked on the various classes of maintenance work and man-hours lost through various causes such as holidays, sickness and waiting time. It was rare for the costing system to produce refined cost information more frequently than weekly, and indeed the most usual practice seemed to be for these figures to be issued monthly. In virtually all cases the accent in the cost reporting was on drawing attention to the exceptions from standard/budget, and similarly it was usual for the information received by a particular manager to be restricted to that concerning the areas for which he was directly responsible. Broader cost information was normally available to any manager on request, but the general aim was to avoid blinding him with figures.

The existence of computer facilities frequently helped in the analysis and functional control of operating costs. We found, for instance, one or two cases where there is a periodic review of such items as the maintenance cost of specified classes of equipment, of equipment of specified materials of construction, and equipment being used to contain, transport or process specified materials. This multi-way analysis of maintenance costs was claimed to give useful clues to cost-saving potential. To make this sort of analysis possible necessitated the coding and marking of each piece of equipment with a multi-digit reference (eleven digits in one case). This reference indicated the works area, the type of equipment and the individual item, and was quoted on every relevant work order form.

3.22 Production

In each company whose works we visited, on both sides of the Atlantic, we made a close study of the process manning of at least one particular process. From the data we collected we arrived at the conclusion that, on average, the production groups concerned with the American processes produced over twice as mucb per head as those concerned with the corresponding British processes.

About two-thirds of this difference we estimated to be due to the effect of the well known difference in scale of the production units themselves. In this connection it may be noted that the capital investment per employee in the American chemical industry as a whole is between two and three times as great as in Britain. In the particular cases we studied, we made an allowance for this 'scale effect'. We arrived at the conclusion that the output per process worker in the American firms was about 25% higher than in the British firms for reasons other than plant scale.

This difference was not consistent throughout our studies. In fact, in the capital intensive processes, in particular those manufacturing single products on a large scale continuous basis, the manning differences were negligible or non-existent if one allowed for the 'scale effect'.

It was in the labour intensive processes involving considerable amounts of materials handling that the Americans appeared to achieve their greatest manpower saving. One of the more obvious means by which this was achieved was their more extensive use of labour saving equipment. We did see some items of equipment that were novel, but the important point is that, in general, it was bigger and there was more of it (see Section 3.24, Labour-saving equipment).

It was also apparent that the British were at a disadvantage regarding manpower requirements in that their processes involved a greater multiplicity of products, grades and packages.

We believe, however, that the most important factor, apart from scale, responsible for the effective utilisation of manpower in the American industry, was the more intensive management effort to reduce costs and hence manning. This was primarily based upon the knowledge gained from experience, supplemented where necessary by the use of a number of techniques to determine the appropriate labour requirements of a plant, including method study, work measurement and activity sampling. One of their most powerful tools, however, was the effective use of cost control procedures, coupled with intensive cost reduction programmes.

Budgetary control, cost analysis and capital expenditure were used on a sound, practical basis to achieve a pre-determined target (see Section 3.21, Cost control).

We encountered two good examples of American management's constant endeavour to reduce manning and of the means by which they accomplished this. In one, a reduction of over 30% in manning had been obtained in eight years over three stages. In the first stage they had spent $3m on new control equipment and new items of production equipment. In the second they had reduced the night shift to a skeleton crew after setting up a computer simulation exercise which had shown the feasibility of this step. The third stage was the result of knowledge concerning the required manning gained during a strike lasting several weeks, during which the plant was run by the staff.

In the other example, the plant output had been increased by 30% over a period of six years, with a reduction of the manning from 150 to 94 men in that same period. This achievement was a result of capital expenditure to convert from batch to continuous process, and of the incorporation of new equipment, making it possible for certain jobs to be combined. Further improvement in instrumentation.and in materials handling brought the manning to its present level. There is now a phased programme covering three to four years, during which it is planned to increase the plant capacity by at least 10% and to reduce the plant manning to about 50% of its present level, that is, to reach a level of about 50 men by 1969. This next stage will involve new technologies and considerably more capital investment.

It is noteworthy that over the full ten years of this programme, the new capital invested in the plant is expected to equal (at 1959 values) the original capital value.

Mention has been made in Section 3.12 (Organisation and quality of management and supervision) of the extent to which functional staff were used to support line management. This is well exemplified on the production side by the use of technical services. For example, in one company, chemical engineers from the technical department were seconded to plant managers, not only to provide advice to operating management, but to operate and study specific plants which had been giving trouble and generally assist the line manager in his job. In another company, 10% of the employees on the site were attached to technical services of one type or another. Amongst these were a number of 'Process Groups' operating on a task-force basis and responsible for 'Cost Improvement Plans'. These Plans were based on a three to five year implementation and generated their own work. About 50/60% of the effort was on process improvement and a 30% return on investment was considered the minimum.

By utilising services such as these, line management had the benefit of a considerable amount of expertise in their constant search for lower costs.

The drive to improve operational efficiency was not confined to management alone. In one company we were much impressed by the Operations Improvement Programme which they had introduced some years ago. At present about 70% of the employees on the site participate each year in this programme. The company believed that those closest to the problems were best suited to apply themselves to their solution and all hourly-paid employees were given a total of eight hours' training in work simplification techniques (similar to our method study approach). The programme has been very successful and 75% of the ideas put forward have been adopted. Over the last five years there has been an average of one improvement per employee per annum. The savings claimed were of the order of $6m a year against administration costs of $200,000 a year, representing a return of 30 to 1.

Apart from the foregoing, we believe that in the American plants there was, in general, better job loading of process operators, particularly in the labour intensive plants, although the operators never gave us the impression of working under pressure. In fact, it was our general opinion with regard to workers of all types in the American firms we visited that their rate of working was no higher than in the UK, although possibly there was more impression of their being 'about their business'. An indication of the scope for improvement in this country is that, despite the fact that processes were more lightly manned, American process operators were still able to do first aid maintenance to the extent of something approaching 10% of their time. In addition the majority of 'in process' testing of products was carried out by them.

We might mention here in passing that in spite of the comparatively low manning of plants, the standard of housekeeping we observed was generally high. There was an almost complete absence of pipe leaks on the sites, which might be attributed to the operators' use of spanners.

Another factor which may be of significance to manning levels was the admittedly high standard of recruits to the American chemical industry. It is possible that this led to easier training and more effective work.

The techniques of supervision were sound. The man-management role of the foreman was emphasised and the operator was given greater individual responsibility. This created greater job satisfaction.

We found a complete absence of chargehands in America. In the American production departments we usually found a ratio of 1 foreman to about 12 hourly-paid, although in two cases the ratio was about 1 to 20. In the production departments of the UK firms, however, we found average ratios of 1 foreman to 5 chargehands to 40 hourly-paid; this is a ratio of about 1 to 7 in supervision, or on the assumption that the time of chargehands is spent half on supervision and half on productive work, a ratio of about 1 to 12.

Similarly we found a relative absence in America of 'assistant foremen', 'assistant managers', etc. Possibly this was due to the greater use of separate functional management and to the provision of clerical assistance where this was required. Junior managers had a very high degree of personal responsibility by our standards, due to the policy, obvious everywhere, of pushing responsibility as far down the line as possible. The result was a commendable degree of dedication to their jobs and a deep desire to justify the responsibility accorded them by the attainment of their defined objectives, which could be summed up as production at minimum cost—and this included labour cost.

About 50% of the total works employees in all the sites we visited were engaged on the production side. If, therefore, the differences we found in the utilisation of production manpower in our samples are representative of the whole industry, and we have no reason to believe they are not, there is room for dramatic savings in this field in the UK.

3.23 Techniques for determining manning

Before discussing the techniques employed in determining manning requirements, we feel it is important to state our view that management in Britain very often appear to regard manning as a matter determined by tradition and workshop sanction. In America, labour costs are regarded as not only controllable but reducible, and management takes great care to make appropriate adjustments to manning from time to time to meet changing conditions or to improve whatever can be improved.

In the determination of the necessary manning for new plant, and in achieving economies of manning, there was less emphasis in America on the use of work measurement techniques than we would have expected. In response to our questions about the use of refined work measurement techniques, as practised in Britain, we were told by one company that they had been used at another works when there had been a particularly sensitive demanning situation. It was felt that if the matter had gone to dispute and arbitration, having used these techniques would stand the company in good stead. This was the only example of the use of these methods we met, and it is important to note that it was for the purpose of labour relations, and as a demonstration of the truth of what management already knew to be the facts.

In determining the manning necessary for a new plant experience played a very large part, although job analysis, method study, isometric drawings and models were also employed. Most members of line management had received some training in work study techniques, but we would certainly attribute American success in this field to the unremitting application of their observation and experience to the task of cutting costs, rather than to the techniques employed.

Activity sampling was commonly used, time study only rarely. On occasion the line management might request a team from the industrial engineering department to study a particular problem or plant; we did not come across any example in the works we visited of the use of outside consultants at works level. Line management was also able to call for advice from staff in functional departments dealing with long term planning and the improvements of materials and equipment.

When work measurement was used the men seemed to accept it as a necessary part of the management function of developing efficient methods and manning of work, and these techniques were regarded as an essential part of management. There was, however, generally a resistance to use of the stop-watch.

3.24 Labour-saving equipment

The general attitude in America to the purchase of labour-saving equipment was probably rather less restrictive than in this country. In one case little formal justification for purchase was required, the attitude being 'the more the better'; in others the necessary pay-off period varied between two and five years. A two-year pay-off period, which is the requirement that the savings resulting from the introduction of a piece of equipment should be such that the cost of the equipment is recovered within the first two years, is perhaps more common in Britain. The considerably higher cost of labour relative to the cost of equipment clearly makes it easier to satisfy this requirement in America.

As mentioned in the section on maintenance work (3.26) there were several instances of separate staffs whose function it was to consider the advantages of new equipment, and this must clearly lead to a greater number of purchases since fewer opportunities are missed. In one case we were told that the management considered the problem to be one of spotting the odd foreman or supervisor who was not willing to spend money on labour-saving equipment, rather than one of limiting total expenditure in this field.

Some of the more obvious labour-saving devices were found in the field of bulk handling, and to some extent therefore are a function of scale. They included large pneumatically discharging hopper wagons, and systems for palletising and for handling sacks and drums. We noted a highly automated plant which filled, sewed and loaded 720 bags per hour directly into huge lorries via a conveyor belt which could be run into a lorry, raised and lowered, moved from side to side, and gradually withdrawn as the lorry was filled up. This equipment was operated by three men, with the help of a stand-by fitter attending to the bag-sewing machine. One man supplied the empty bags, one saw that the correct code numbers were automatically printed on the bags and kept an eye on the machine, including the counter which recorded the number of bags of correct weight and the numbers falling both above and below the narrow band of acceptable weights. The third was in the lorry, controlling the position of the end of the conveyor, and ensuring that the bags were packing neatly as they came off the conveyor.

Another system, operated by one man, filled weighed and sealed 50lb bags and organised them in neat stacks of 40 bags each on a pallet; the multi-wall paper bags were glued together so that each stack was an easily managed unit weighing about one ton which could readily be broken down at its destination.

There was considerable use of fork-lift trucks, often with special attachments for handling such things as drums, and also of palletised loads. In one place we saw light-weight ramps, which could be carried by one man, used to enable fork-lift trucks to negotiate small differences in floor levels. We also saw several installations of the Kelly loading deck. This device, built into a loading dock, provides a means of adjustment of minor differences between loading dock height and tail-board height. This enables fork-lift trucks to drive right into road trucks and rail cars for loading and unloading.

Another useful device we saw at one location was a vehicle known as the Strad-O-Lift, used for shifting skids loaded with up to 36 pallets. The vehicle was articulated, the tractor being transferable to other duties. The trailer unit consisted of an inverted-U framework mounted on wheels without transverse axles. The sides could be raised, lowered, and moved in and out hydraulically.

The trailer could be backed astride a skid of pallets and, when in position, the sides pushed inwards so that narrow shelves on their inside lower edges gripped under the sides of the skid. The whole load could then be raised about a foot off the ground and towed away. This type of vehicle was even being used for certain short journeys on public roads.

An impressive arrangement at one works involved the use of one-ton rubber containers in conjunction with an overhead monorail system (the whole was generally referred to as the 'cow system'). This system was designed for handling and storing an intermediate product, and controlling its flow rate to the area where the next stage of the operation was carried out.

Intercommunication systems of various types were commonly used; at several of the works we visited radio 'bleepers' were employed. On one site we noted the use of teletype facilities for the rapid transmission of urgent messages within the site.

Bicycles and, on the larger sites, cheap, light weight, one-man motor-scooters were much in evidence. These scooters were usually assigned to foremen but the men were permitted to use them. One company was particularly well equipped with motorised trucks, each of which had a platform of 8ft × 4ft and was able to haul 2500 lbs. These were freely used by all personnel. Four of the trucks had portable welding machines permanently fixed to their platforms for easy movement to any part of the site. Another simple device which we met was a small hand trolley designed to carry a craftsman's tool kit.

The policy of avoiding the use of people on jobs which could be performed more efficiently by machines was in evidence in the offices as well as the factories. At one company they were studying pipe runs and modifications by superimposing them on enlarged photographs of existing plant. By using photographs instead of drawings they claimed to have saved a great deal of time and reduced the need for draughtsmen.

The use of computers or computer-time to handle voluminous accounting routines was almost universal, and smaller office equipment for the less voluminous routine jobs appeared generally to be of a very good standard and well chosen. Special purpose 'ready reckoners' were invariably used for routine calculations of local significance, such as the conversion of tank dips, temperatures and densities to inventory weights. We do not suggest that there was a vast gulf between British and American practice in these respects, but it did seem that the Americans had made more positive efforts in this direction.

3.25 Instrumentation and automation

The degree of automation and instrumentation was not obviously greater than that which obtains in Britain. Instrumentation costs were, in general, about 5% of the capital cost of plants.

We formed the impression that the Americans were working very busily on the application of computers to direct process control, but we were not fortunate enough to see it in operation at any of the sites we visited. We did not pursue this point, since we accepted that our hosts would have felt that it was outside our terms of reference. We saw one example of process optimisation by computer.

3.26 Maintenance work

The field of maintenance work offers great scope for cutting costs and increasing the efficiency of utilisation of manpower. We found very striking differences between British and American practices, and these are discussed later in this section, under the headings 'Elimination of unnecessary maintenance work' and 'Efficiency in maintenance work'. It is convenient to start by considering the organisation of American maintenance departments.

(a) *Organisation*

There was no doubt that the Americans recognised that scientific maintenance is a major factor in increasing and sustaining plant productivity. To this end the maintenance manager was usually a senior member of the management team and in some cases had direct access to the managers of corporate maintenance departments who were at or close to Board level.

The organisation of the maintenance departments in America varied, and was clearly tailored to suit local conditions and even personalities.

Routine maintenance of a very simple nature, such as pulling up pipe flanges, was normally done by process operators. More complicated mechanical work was the responsibility of craftsmen based on area workshops, and supporting these area workshops there would be a central workshop which dealt with the heavier work and also included the specialist trade shops.

The area workshops were there for geographical convenience, and their size and complexity varied according to the situation; the level of supervision ranged from a foreman to a qualified engineer with assistant engineers and foremen beneath him. In practice the manning of the area workshops was fairly stable, so that the craftsmen became familiar with the plant in their area. It was however fully understood that all the men were based on the central shop and management were able to move men freely to a different area when necessary to meet an increase in demand for maintenance work. By this means a satisfactory blend of experience and flexibility was achieved.

It is of interest to note that at no site that we visited did the area production managers control the area workshops. We were told at one works that this had been tried but abandoned as wasteful because of the fluctuations in the work loads in the different areas.

Reverting to the general problem of the approach to the organisation of maintenance, the outstanding characteristic of the American system, as mentioned in 3.12, was the extent to which the responsibilities for certain specialist functions were delegated to separate staffs, so that the numbers of management directly responsible for the execution of work were small.

Examples of such specialist functions on the maintenance side included:

(a) Work planning. This covered the daily planning of the work of the maintenance department and is dealt with more fully in the section 'Efficiency in maintenance work'.

(b) Maintenance investigation. This involved studying alternative materials and equipment with a view to reducing the amount of maintenance work. It is referred to in the section 'Elimination of unnecessary maintenance work'.

(c) Evaluation of labour-saving equipment.

(d) Training of craftsmen.

(e) Consideration of priorities for maintenance work. This was usually the responsibility of the planning section.

In some cases the maintenance department was able to hire qualified engineers from the design engineering department to assist with specialist work when required.

The advantages of this system of management specialisation, which limits the range of individual responsibility and ensures that forward thinking is not squeezed out by the pressure of more immediate problems, are obvious but cannot be over-stressed.

(b) *Reduction of Maintenance Costs*

The most important factor in achieving economies in maintenance in America, both by eliminating unnecessary work and by increasing efficiency, was undoubtedly the fact that the entire staff of the maintenance department was striving to keep maintenance costs down. It was not uncommon for budgetting to go down to the level of foreman, on both the production and the maintenance sides, and the ability to achieve or beat targets in cost reduction was a major factor in the regular assessment of members of management. False economies, which reduce the maintenance budget at the expense of a greater increase in costs for the production side were kept under control by taking into account the cost of 'down-time', and by the fact that the production manager, as part of his overall responsibility for the costs of production, had a responsibility also for the associated maintenance costs.

Those who were directly responsible for the executive control of maintenance work were aided by the specialist support staffs, and by the application of the cost analysis and cost reduction systems which are described in the following sections.

(c) *Elimination of unnecessary maintenance work*

The quantity of maintenance work in America was controlled by the system of work authorisations. Jobs were requested by the production side, on 'work order forms'. Except for emergency or standard routine jobs these were sent to the planning staff for costing before the job was authorised by a member of the production staff. The limits of authorisation for the various levels of management were low by British standards, and for non-essential work, such as improvements rather than repairs, they were reduced still further. As a result of this system, the man authorising any particular piece of work was fully aware of the cost and on the basis of this cost he decided whether to have the job done or defer it.

Separate maintenance investigation departments or staff were quite common; their function was to investigate alternative materials, equipment and procedures with a view to achieving maintenance cost reductions. A good example of the work they did was where a plant had been requiring an excessive amount of maintenance work as a result of corrosion. The sections of the plant which had been giving trouble were now being made of titanium instead of steel.

The work of maintenance investigation was aided in some cases by a detailed analysis, by computer, of the information derived from the work order forms. This produced figures for the costs of maintenance of individual items of equipment. Items which cost too much to maintain could either be scrapped and replaced, or redesigned to give better performance.

Another important feature of the American effort to reduce maintenance costs was the great care which was taken at the design stage of new plant to see that details which had considerable bearing on the ease of maintenance were not overlooked. Consideration was also given to minimising safety risks. Too often British design engineers appear to forget that the plant will have to be maintained, and make some of the maintenance jobs inaccessible and difficult to a degree which is quite unwarranted. It is not unknown in the UK for plant to be designed in such a way that it cannot readily be drained of the dangerous liquids it contains, so that the maintenance workers are exposed to unnecessary danger. Sometimes all that is required is to introduce a slight slope into the horizontal pipe runs.

In the 1952 Productivity Team report, 'Heavy Chemicals', considerable stress was laid on the importance of scheduled maintenance. This was defined as maintenance carried out to a programme originally drawn up perhaps six or twelve months in advance, and added to as required. This programme, or schedule, shows on what day each overhaul or inspection is due. The time interval on the schedule between like entries may be fixed by statutory obligations, such as boiler inspections, crane testing, etc., by other safety requirements, or by purely production or technical considerations, and will be governed in part by the desirability of spreading the labour load and the machine utilisation evenly over the year.

It was stated in the 1952 report that on average 20%—30% of the maintenance effort had been scheduled, that this percentage was increasing, and that the American view was that the aim was to reach 100% scheduling. Our experience was very different. Far from increasing the proportion of maintenance which was scheduled they appear to have reduced it to a figure generally between 10% and 15%. This was sufficient to cover work on boilers, pressure vessels, and other essential machinery and thus to avoid major write-offs.

The view expressed to us on this point was that scheduling maintenance could well result in doing too much maintenance work because it was extremely difficult to determine the correct interval to be used. Almost without exception, when scheduled maintenance is introduced for the first time, or for an unfamiliar piece of equipment, the period between inspections is made too short, 'to be on the safe side'. As time passes and experience is gained the inspections often show that no work is necessary and the period should be lengthened. Careful attention to this point can often make a considerable reduction in costs possible, without abandoning the scheduled maintenance concept, which we are sure has merit.

The American system was usually to run the equipment until there were signs that it needed attention (such as a fall in the quality or through-put of the product) and then to switch in a spare (preferably an installed spare) while the necessary maintenance work was done. We believe that in Britain there has been a considerable move over the past ten years towards greater use of scheduled maintenance. It might now be desirable for some companies to make sure that the experience they have gained is being properly used to reduce the frequency of inspections or to consider whether there is any merit in following the American lead and pay somewhat less attention to the practice of scheduling.

The greater use of the installed spare which we found in America reflected the general appreciation of the cost of 'down-time'. The next best thing to an installed spare is to have a spare ready in the stores for immediate replacement of an item which requires attention, a system which should often prove far more economical on down-time than waiting for a broken part to be replaced. The right course is obviously that which produces the lowest cost, but there are many factors involved, some of which are not susceptible to precise measurement, and some, such as the relationship between the cost of spare items of plant and the cost of maintenance labour, are different on this side of the Atlantic. It is most important in considering this matter not to look at the maintenance department in isolation but to take into account the heavy cost of the unnecessary loss of production which arises when plants are shut down for over-frequent maintenance. This is another example of the need for care in assessing the true result of any decision, a point which is emphasised in other sections of this report.

(*d*) *Efficiency in maintenance work*

A striking feature of the American approach to maintenance work was the importance of planned maintenance. Using the definition of the 1952 report, this is maintenance carried out on any job by a specified method, all the details of which have been worked out some time before-hand so that materials are ready on the site, the correct tradesmen and other workers arrive at the appropriate times, and as much effort as necessary is directed into ensuring that the job can be completed to a time previously specified.

Planning was regarded by the Americans, and by us, as playing a major part in achieving maximum efficiency in the utilisation of the available labour force. This point was made in the 1952 report but both the system and the degree to which it is used seem to have developed considerably since then. The planning system was closely linked with the work order and authorisation procedures which are also mentioned in the preceding section and the section on cost control.

The planning staff were responsible for analysing the work requested on a work order form and estimating the cost of the materials involved and the number of man hours required within each trade. This estimation was based upon practical experience and historical records, with the aid of the appropriate maintenance foremen if necessary. For emergency work the costing was done after the work had started, but for routine maintenance and non-essential work costing preceded authorisation.

When the work had been authorised the planners assessed its priority in relation to other jobs. Each day the planners considered the work which had to be done on the following day and that which was currently proceeding and produced by perhaps 3 pm a detailed list setting out the work which had to be done on the following day and the men who were assigned to do it. The planners also checked that the tools, materials and any fabricating work necessary for each job were available and arranged for them to be brought to the place where the job was to be done at the appropriate time. Each foreman on the maintenance side had before the end of the previous day the list showing what each of the men under him was expected to do and how long each job was expected to take. Copies of the appropriate work orders and starting times were also sent to the foremen and superintendents on the production side.

This central planning relieved the maintenance foreman of most of the problems connected with disposing his labour force and ensuring that the necessary tools and materials were available, and enabled him to concentrate on seeing that the work was done well. The use of specialist planners, responsible for the whole works, ensured that the deployment of the work force was efficient, and that the priorities allocated to jobs were determined by their importance expressed in terms of profits rather than by the rank or strength of personality of the man who had requested the work. The maximum use of a craftsman was made possible by the elimination for practical purposes of wasted time waiting for tools or materials.

As a result of the 100% allocation of each craftsman's time there was normally a back-log of work resulting from the introduction into the system of emergency, high priority or breakdown work. At one works they measured the back-log monthly and studied the run of figures to see whether the maintenance department was running efficiently or needed augmenting. When it became necessary to interrupt the planned work in order to carry out more important work the planner was consulted and he decided which men to take off the job they were doing. He then took the men from the job which had the lowest priority and revised his pan.

Since each maintenance foreman knew from the information supplied to him by the planner, the time which each job was expected to take, he was able to supervise the men effectively and see quickly when anything was going wrong. The actual time spent on each job was recorded on the work order and could he compared with the estimates and used as a basis for modifying future estimates for the purposes of planning and costing.

A system of 'standard work orders' had been devised to save planning work on maintenance tasks which recurred frequently. These jobs were assigned a standard work order number and could be authorised without the need for prior reference to the planning department since the costing had already been done.

In addition to the development of the planning system, considerable attention had been given to determining the most efficient way of carrying out a job. In one works, by a process of analysis and discussion coupled with practical trials a formally constituted committee had produced a 'standard operating instruction' which set out in the necessary detail and correct order all the steps involved in completing any particular task. This instruction also listed the safety requirements and the necessary tools and materials. Modifications were introduced from time to time to take into account any developments in technique and equipment. Once a standard operating instruction had been finalised copies were printed and circulated to each man on the maintenance staff who kept them in a handy pocket folder. He was expected to familiarise himself with the procedures and to follow them in all cases.

Another system, based on a similar approach, was designed to take the 'magic' out of instrument work. For each instrument used on the works an 'instrument maintenance outline' had been produced, listing the symptoms of all possible malfunctions of the instrument. Then for each symptom was listed the possible causes, the procedure to be followed in order to determine which of the causes was responsible and finally the action to be taken to rectify the fault. (These instructions are published by the Industrial Photo-Fact Division of Howard W. Sams & Co, Inc, Indianapolis, Indiana.)

3.27 Use of contractors

Contrary to our expectations, we found the use of contractors to be rather limited. We would not, therefore, subscribe to the view that greater use of contractors in America reduces the number of direct employees of the chemical industry and is thus a major factor in explaining why the national statistics show a higher figure for output per employee in America than in Britain. We did, admittedly, visit one plant where all maintenance was contracted out, but even here there seemed to be doubt as to whether the initial advantage of being able to vary the labour force in line with fluctuating demand more than compensated for the higher cost per man-hour in the long run. The more common practice seemed to be to use contractors to take care of the peaks in the maintenance demand; American management appeared to be able to do this more effectively than their British counterparts. One possible reason was that in many areas, although not all, it was comparatively easy for an American factory to obtain maintenance contractor assistance when required and quickly.

Often the union was against the employment of contractors on maintenance work and it was necessary for management to make out a case before bringing in contractors. The union argument was that if there was more work than the labour force could handle more men should be taken on. This point did not appear to be pursued to unreasonable lengths.

In both countries we found the majority of plant construction work, as distinct from maintenance, to be undertaken by contractor effort. Where there was a relatively steady stream of capital development projects there tended to be a basic construction force within the organisation, supplemented by outside contractors as required.

There are other tasks, in addition to engineering, for which contract labour may be used. On both sides of the Atlantic we found some cases of contractors being used to man canteen facilities. There did not appear to be any significant difference in practice compared with the position in Britain. Occasionally a company would have a small skeletal transport force of its own to cope with a regular base load of deliveries, but this rarely accounted for a significant proportion of the total output. This practice may differ from that in the British chemical industry as a whole, though it must be said that it was not in sharp contrast to the small sample of British companies we visited. We also saw some cases where small peripheral services such as laundering and window cleaning, were contracted out, but this did not appear to be of major significance.

We doubt whether differences in practice with regard to any of these uses of contract labour accounted for more than a very small part of the apparent difference in output per employee in the chemical industries of America and Britain.

3.28 Maintenance and consumable stores

A variety of systems for operating the stores was found; in some cases there was a central store and in other cases there were area stores. As part of the general cost-consciousness the capital tied up in stores was kept under close scrutiny. Computers were often employed in the work of controlling the stores. Where this was done, it was usual for the computer to be programmed to print out purchase requisitions automatically when the pre-determined re-order level for any item was reached. In one case where this was not done, and purchase orders were initiated from the bin card records, the bin card was accompanied by a 'rotating requisition' card. This detailed the specification of the item, the normal and alternative suppliers, the standard purchase price and the standard re-order quantity. When stocks reached the appropriate level, this card was passed to the purchasing agent without the need for writing out an individual requisition. All that had to be done was to check the adequacy of the standard re-order quantity.

In some cases there was a regular procedure for studying the stocks of individual items in order to see that over-large stocks were not being held; in one case this was being achieved by continual computer comparison of actual stocks with pre-determined standards. On occasion excess stocks of slowly moving items were returned to the manufacturer. Another system of control incorporated the provision that before a new item was taken into the stores it was necessary to obtain the approval of the maintenance superintendent, the maintenance manager *and* the works manager.

Efforts were made to take part in the design of turn-key projects to ensure that these projects did not lead to unnecessary multiplication of the number of items which had to be held in stores.

One large company had been able to persuade its major suppliers to hold stocks of spares in depots just outside the company fence, so that supplies could be obtained rapidly but company money was not tied up. The stocks in these depots were recorded within the company's own computer.

Most companies used a system of free issue of 'low cost multiples'. Under this system cheap items which were used in quantity were not separately requisitioned but simply taken as required from mobile trailers which were placed at various positions around the site and re-stocked by the stores department. It was claimed that the consequent saving in time and record keeping more than offset any possible extravagance in use.

Delivery systems were sometimes used. In one works, for example, a truck made a regular tour of the site every 30 minutes and delivered goods which had been ordered by telephone. It was claimed that this measure by reducing the time spent on journeys to and from the stores had made a significant improvement in the utilisation of craftsmen, as determined by activity sampling.

An interesting idea that we met was moving the entire instrument department into the stores area. Instrument stocks are difficult to control and it was claimed that the introduction of this practice which transferred the responsibility for the paper work from the instrument mechanics to the store keepers had produced a great improvement. Consideration was being given to moving the electrical department into the stores for the same reason.

3.29 Management teamwork

In all the companies that we visited in America we were impressed by the unity or team spirit or comradeship, call it what you will, which appeared to exist in the management. This is difficult to define and explain. It may have been a direct result of the fact that areas of responsibility were accurately defined and known. It may have been the result of the basic philosophy of American management. We realised that there was bound to be a temptation for our hosts to put on a good show for the outsiders but we are convinced that it was not purely display. One senior member of management explained it to us by ticking off on his fingers the various management functions and then by locking his two hands together and thrusting them forward illustrating that they were working as a single unit for a common objective.

There is a feeling too often prevalent in the chemical industry in Britain that the plant manager should be capable of carrying out and being a specialist in every discipline that his job requires. If a senior member of management feels that it is necessary to introduce some functional specialist to correct or improve a situation, all too often the plant manager is apt to resent this and to take it as a reflection on his ability. This was not the situation in the large works that we visited in America. There, managers at all levels seemed to accept that management of situations and people was the essence of their jobs, necessitating the use of the best specialist advice available. This advice might be obtained from one of his superiors, an executive in another section of the organisation, or even one of his own subordinates.

By way of illustration of this point, production supervisors were both willing and eager to receive specialised assistance in any area of their duties and in many cases were thereby relieved of a number of the functions for which they had been but superficially trained and of others which were of a routine nature but nonetheless time consuming. In this way the American production supervisor was free to concentrate his efforts on the basic necessity of getting the right volume of goods produced at the right time to the right specification within the target of cost that had been agreed.

There was a definite and willing acceptance of the fact that management was a team function and that all members of management were operating to achieve a common goal, each member having his own important part to play, and that only by complete co-operation could the company's goals be achieved.

This is a difficult point to put over and we hasten to point out that in none of our visits to British sites did we encounter any evidence of friction, squabblings or similar pettiness. Nonetheless, from our own personal experiences we would hesitate to say that such situations never occur. In Britain it would be rare to hear a member of the line production management extolling what a wonderful job the maintenance department were doing in keeping his plant up to scratch or eulogising upon the efficiency with which the members of the accounting function provided him with the information he needed to identify the areas in which cost savings could be achieved. However, in more than one factory in America such tributes were paid to the support functions.

It boils down to our having to accept that in America management team work is the established order of the day and it involves much more bearing one another's burdens and working together for the common good and considerably less of the prima donna approach of jealously protecting one's own territory and sphere of influence.

Some companies, recognising the importance of this co-operation, had introduced training schemes which had as one of their main aims the development of this attitude amongst their managers. The value of this training, known under various titles including 'T Groups', 'Sensitivity Training' and 'Group Dynamics' was the subject of much debate but the technique appeared to be gaining popularity, and one of the large companies we visited told us that the top 900 of their management had all been given such training.

3.3 Comparison of employment practices

3.31 Recruitment and selection

In America in the companies we visited it was very rare for men to be taken on as hourly-paid workers with already acquired skills and experience in the chemical industry. Generally the seniority rules governing promotion (see Section 3.33) discouraged mobility of hourly-paid labour between one company and another. We did nevertheless come across a very few cases where men with recognised skills, particularly in certain maintenance trades, had been engaged as something better than 'green' labour. Generally speaking, the new hourly-paid employee was recruited at the lowest rates of pay, either into a labour pool or as a trainee for one of the lowliest process or general jobs or as a maintenance 'helper'.

Another thing which struck us as being significantly different from British chemical industry practice was the fact that all the companies we visited in North America aimed at a seemingly high minimum educational standard. It was very much the exception for anyone to be recruited without having graduated from high school grade 12* (or the equivalent), and in some cases the desired minimum standard was even higher. Generally speaking, within the area we visited this quality of labour was obtainable. Even in those places where we were told that recruitment was getting difficult, it transpired that the only difficulty was in finding the requisite numbers of personnel of this minimum quality. In effect, therefore, apart perhaps from such jobs as janitor and cleaner, the chemical industry in this part of America was almost closed to new entrants without this minimum standard of education. This remark was made to us on more than one occasion.

---

* It is difficult to translate the concept of 12th grade since the British educational system differs from the American in many ways. The school starting age in America is six not five. High School covers children between 14 and 18 years of age, that is grades nine to twelve. Education beyond that level is obtained at colleges. The best advice we have is that American boys leaving at the end of the 12th grade are approximately equivalent as a group to British boys who leave school at 16. Another indication of the standard required by the American chemical employers is given by the results of a survey carried out in 1965. This showed that of all Americans over 25 years of age, some 50% had not completed 12th grade, about 30% had left after completing the 12th grade and less than 20% had received full-time education beyond that level (Dept. of Commerce, Bureau of Census, Current Population Reports).

That the chemical industry was able to be as selective as this in its recruitment illustrates that in America the chemical industry is widely regarded as providing a good career.

The regulations in Britain governing certain types of chemical works prohibit the employment of anyone less than 21 years of age. As a result only a limited proportion of the industry's workers have entered the industry straight from school; most have tried another job first. This system has the obvious disadvantage that school-leavers seeking a career other than by an apprenticeship will not look to the chemical industry for employment. The situation regarding recruitment for the industry in Britain therefore contrasts unfavourably with that in America.

As is already widely known, differences of geography and differences of standard of living have contributed to an entirely different attitude to travelling in America from that in Britain. Consequently it was not surprising that in most places the immediate catchment area for a chemical plant had a radius of perhaps fifteen miles. In many cases a not insignificant proportion of the employees were travelling daily distances of 45 miles and more between home and place of work. This clearly made available a proportionately larger population from which to select prospective employees; it also brought into consideration many small-time farmers who were interested in having a second paid occupation.

Selection procedures varied in detail, though the normal basic pattern was for personal interviews and reference checking to be supplemented by some form of systematic test. In some cases these tests were of the general IQ type, but we found that in some places this had been progressed to the point of applying scientifically designed job-related aptitude tests. It was normal for the applicant to be asked to submit himself to a medical examination before being accepted. It was interesting that one or two companies made the point to us that all these selection procedures had to be justified in relation to the employment being offered, in order to avoid contravening the Human Rights legislation.

It was not uncommon for the management/union contract to provide for a probationary period of, say, 60 days in which management had absolute discretion to decide whether or not to retain a new employee. Beyond that period the employee became established and suspension or dismissal could give rise to a grievance under the contract.

It was significant that we found no evidence of any deliberate attempts to recruit personnel judged to be suitable only for the more menial jobs. Although virtually all hourly paid employees were brought in at this level, the aim in all cases was to find potential for development into the most skilled positions. Jobs not calling for a high degree of physical or mental ability were often reserved to provide worthwhile employment for employees who became mentally or physically handicapped during the course of their employment. That this was done without any statutory requirement for American businesses to employ a proportion of disabled persons was to the credit of those companies which we visited.

It seemed to us that on balance the American practices we saw in relation to recruitment and selection of hourly-paid employees were likely to produce better results than in Britain. The obvious dsiadvantage of engaging a reasonably well-educated man to undertake totally unskilled work was that his innate ability was being under-utilised until such time as the seniority rules had allowed him to reach the job-skill level for which he was best equipped. On the other hand, the system seemed to us to produce a labour force which had the following significant advantages:

(i) It was well able to recognise the need for change and thus more readily accepted change.

(ii) It was well equipped to negotiate objectively with management.

(iii) It was well equipped to learn new and complex jobs, so that training times could be shortened.

(iv) It was well equipped to operate chemical production processes with the minimum of technical supervision.

(v) The men were eager to progress through the various job grades to the most highly skilled of the hourly-paid operatives.

(vi) The consequences of losing seniority, and thus income, by moving from one company to another gave each man a significant personal interest in the prosperity of the company for which he worked.

As regards salaried employees, we found no significant differences in recruitment and selection techniques between the industry in Britain and the industry in America, and certainly none which appeared to have a bearing on manpower utilisation.

3.32 Training

(a) General

Our visits left us with the feeling that there was a more conscious use of training to improve manpower utilisation in the American chemical industry than in its British counterpart. This was not so much because of the differences in techniques as because of an apparent difference in the basic attitude of management to training. In America the general approach to training was to use it as a means of getting the individual to do a more effective job in the task to which he was currently assigned or, in some few cases, to equip him to do a better than average job in a new position to which he was about to be transferred. We found no instance where training was being undertaken for training's sake. If a man at any level in the organisation wanted to be given broad training, then the general attitude was to leave him to exercise the initiative. If the broad training he was looking for could be of some benefit to the company, then he was given encouragement, including material help, provided that satisfactory results were forthcoming. Unless the broader training was likely to bring benefit to the company within a reasonably short period, then the individual was given some moral support but, generally speaking, no material help.

By and large the American employee seemed much more eager than his British counterpart to have the benefit of training, no doubt because of the greater promotion prospects available to him. There was a general feeling that American managements should be providing more training opportunities. In some cases the American workers expressed resentment that they had to rely so much on their own initiative in the field of training. Similar objections were not raised by any of the American salaried staffs we met.

(*b*) *Process and general workers*

We found virtually no use of external training being made in the case of process workers in America, other than where men were taking correspondence courses of their own initiative. Similarly, very little use was being made of internal classroom training, other than as part of a brief induction programme in some companies. The vast bulk of the process operator training was being done on-the-job, generally under the tutelage of a trained operator. In some cases a small percentage of the total process operators was being trained to cover two or three jobs. Almost invariably the process foreman concerned was executively responsible for the training given, though in some cases he was provided with specialist assistance in devising the training programme. By the same token it was normally the process foreman who was responsible for assessing the trainees' progress. This was in keeping with the general practice of delegating as much man-management responsibility as possible to the first line of supervision.

We found in America no industry-wide basic process operator training comparable with our qualified chemical operative training scheme. Consequently it seemed to be rare for a process operator in America to be capable of moving freely from one type of process to another unless he had already in his career been trained for a variety of specific jobs having characteristics in common with the new job. At least one company, however, had recognised the desirability of this type of transferability and had, in recent years, started introducing its own series of training systems on general chemical process operation. We understood that there was some resistance to these schemes on the part of the employees, but the basic scheme, designed to give a general appreciation of chemical manufacturing operations, had now been accepted as compulsory for all the company's chemical process operators.

Overall it was difficult to assess the extent to which these differences in approach resulted in improved manpower utilisation in America. By and large it seemed likely that although the American managements lost something in terms of transferability of process operators, they gained quite significantly by turning out operators trained to undertake broad, though specific, jobs with the minimum of supervision.

(*c*) *Maintenance men*

In America we found no indentured craft apprenticeships; it was, nevertheless, possible for maintenance tradesmen to acquire recognised skills, even to the point of certification by the US Department of Labor, through successful completion of training schemes within their own company. The age at which such training commenced tended to be considerably higher than in Britain, it being possible in most cases for men up to the age of 35, and in some cases even up to the age of 45, to embark upon such training. It was normal for the conditions and procedures governing this training to be defined in fair detail in the company's contract with the union.

Recruitment for positions on the maintenance side was normally from among men already employed at the works, by a process of selection from those applying for an advertised job. For certain trades it could well be necessary to pass tests of aptitude and intelligence, and to have successfully completed one or two years at high school in mathematics, physics or chemistry. Seniority played a considerable part in the selection procedure once the initial weeding out had been done.

The training period for a craftsman varied between one and four years, and could sometimes be reduced for (a) men with training or experience gained at other companies, (b) men who had considerable experience with the company, or (c) men who did particularly well during training. The major part of the training was on-the-job, but it was common to find this supplemented by correspondence courses either in or outside the firm's time. During the training period it was normal for the trainee to be permitted, even encouraged, to use tools. Towards the end of a man's training period he would be quite likely to be working as a fully skilled craftsman. We met only one company in which there was a predetermined ratio of craftsmen to trainees, and even here the members of any particular craft could decide as a group to waive that ratio.

The main feature of craft training was that men were taught the skills necessary for a particular job on a particular site. Entry into a craft was only possible at the lowest level and craftsmen could not, therefore, move to another company, or to another works of the same company, or even to a new craft at the same works without starting again as unskilled men and working their way up the ladder. This restriction means that craftsmen cannot acquire transferable skills and their security of employment depends upon the seniority provisions of the union contract and the security of the works itself.

(*d*) *Foremen*

We were greatly impressed by the amount of attention paid to training foremen in America by comparison with Britain. The American managements clearly recognised that two of the basic essentials of the foreman's job were (a) man-management, and (b) acting as a two-way communication and interpretation link between the hourly-paid workers on the one hand and management on the other.

It was very rare for an American foreman to start working in that role without at least a few days intensive training for the job. Most foremen had the benefit of several weeks' training immediately after appointment, or within a few months of appointment in a few cases where it was desirable to accumulate three or four trainees for a joint course. Training before appointment took place in some companies but was not the general rule. The great weight of the training was off-the-job, and in many cases much of this was done outside the works. The basic element invariably was supervision techniques, but it was noticeable that considerable accent was placed on training in communication techniques, safety and employee appraisal. In one or two places we found in force a programme of periodic re-appraisal and refresher training of foremen, aimed at ensuring that this link in the management chain was continually maintained at a high level of effectiveness.

The foreman is the management representative most closely in touch with a large proportion of any manufacturing company's manpower. It seemed to us that this high level of attention to training and maintenance of foremanship skills made a significant contribution to manpower utilisation in America.

(*e*) *Other salaried staff*

Where training of existing management members was concerned we found little difference in practice between British and American companies. On both sides of the Atlantic we found a minimal amount of effort expended on systematic broad training, but some effort being devoted to grooming men with potential for higher management responsibilities. As would be expected, the detail of the techniques used varied from company to company, and the level of this training tended to be higher in the large companies than in the small. In both countries use was made of some induction training to let the new employee see the overall context in which his job was to be performed. Thereafter it was not uncommon for middle-management employees to spend periods of about six months in each of several departments, to supplement this induction training and to determine the functions in which their potentialities could best be realised.

In America only occasional use was made of external facilities such as courses run by the American Management Association and the Harvard Business School, to increase managers' capacities within their existing jobs or to broaden their outlook and prepare them for promotion. Generally speaking, broader training was obtained only by the exercise of the man's own initiative.

There was rarely any formal training, on the employers' initiative, of American junior clerical and laboratory staff, though some companies gave encouragement and some assistance to such personnel showing the initiative to improve themselves.

In the largest American companies some specialist staff were occasionally given leave to undertake limited academic work; however this was the exception rather than the rule. We also came across isolated cases where selected groups of managers within a company were given occasional internal training sessions, using techniques such as group dynamics, with or without the assistance of outside specialists.

3.33 Promotion

Promotion among hourly-paid workers in America was governed by the provisions of the union contract. When a vacancy occurred the job was advertised within the works ('posted') and men were then entitled to apply ('bid') for the job. Selection, however, was nearly always strictly on the basis of seniority, usually within the department concerned. The effect was to restrict management's ability to select, in their opinion, the best man for the job. The man entitled to the job was the most senior who could not be shown to be incapable of performing the job.

In some cases, usually at the smaller works, skill and aptitude were the major factors in selection; for jobs on the maintenance side there would often be formal tests of intelligence and mechanical aptitude. In all cases it was fair to say that seniority plays a very large part and the unions were concerned to see that this was so.

The important part which was played by seniority in promotion made the selection of recruits even more important. It also meant that all new recruits starting at the bottom of the ladder could expect to better themselves in due course. More able men would rise more slowly than in a purely competitive situation.

The practices governing promotion to the rank of foreman, which involves joining the ranks of management and giving up membership of the union, were similar to those in this country; the union contract was not involved and therefore seniority played a small part; the main criterion was the man's ability, in the opinion of management, to do the job. It was noted that men who had shown up well on the Grievance Committee and exhibited inherent leadership ability were often selected to be foremen. Because they usually lacked the necessary technical qualifications or technical ability, foremen were not often promoted to higher levels of management.

We did not attempt to study the subject of promotion within management, but it was very clear that promotion depended on performance, and that performance was frequently and accurately assessed in terms of the achievement of the individual's objectives. These assessments were usually made for each junior member of the management at regular formal meetings of senior management.

3.34 Payment systems

Hourly rates of pay in the American companies we visited were almost invariably determined by some sort of job evaluation, but in general the analysis was not carried out with the same degree of formality that we find in Britain. The application of work measurement techniques was occasionally involved at the stage of the preparation of the job description, and it was not unusual for a representative of the union to be part of the job assessment committee. What was quite universal was that the rates proposed by the job assessment committee were only finally established in the union contract after a considerable period of discussion and bargaining by the negotiating committee. The result was that in most cases there were numerous different basic hourly rates of pay (nearly thirty in one case). Even in the maintenance force, where craft demarcation tended to be less than in Britain, it was not unusual to find between five and fifteen different rates. The levels of the hourly rates and the ranges between the lowest and highest rates varied from company to company; at one works they ranged from \$1.75 to \$2.75 an hour, at another they ranged from \$2 to \$4 an hour.

The common practice was to take account in the basic rate for the job of all the measurable special conditions attaching to that job. There were consequently no special conditions payments such as dirty money or height money.

In the factories with numerous job rates there was a tendency for men with the requisite seniority to bid their way up the job rate ladder. This could result in job changes being undesirably frequent, with men being transferred before or soon after reaching the peak of proficiency on a given job. It was of interest that one company had tackled this problem by introducing a stability bonus. Under this scheme an operator received a 2 cents an hour increase if he did not bid for an up-graded job for which he was qualified within six months after appointment to his existing grade, and a further 3 cents an hour if he still did not bid for an up-graded job after a further twelve months. We did not discuss this system in detail; it seems likely to have the merit of discouraging men from applying for transfers to other departments in order to obtain an up-grading involving an increase of only a few cents an hour; such transfers involve a waste of much of the experience gained on a particular plant. At another works all hourly paid grades received fixed 'merit' increments after stipulated periods in those grades, subject only to satisfactory work. This system probably produced similar results, but whether that was its main purpose we cannot say.

We found some cases of merit rating schemes being used in relation to salaried staff, but no true case of merit rated increments for hourly paid employees.

Incentive bonus schemes were rare. We found that a few such schemes still applied to a very small proportion of the workers, but such schemes as were in force were of long history and were not regarded by either management or employees as being particularly desirable because they were difficult to administer and the source of many grievances. We heard of several cases of such bonus schemes being bought out. Only one detailed example of such a buying-out operation was quoted to us and it may not be typical. It concerned a maintenance group in which the bonus earnings had been averaging 35 cents an hour, with a range between 20 cents and 60 cents. This had been dealt with by raising the basic rate of every member of the group by 23 cents, plus a further 12 cents reducing at the rate of 2 cents a year. New members of that maintenance team now receive the basic rate inflated by the 23 cents increment, but do not receive the additional 12 cents.

Overtime premiums were fairly uniform. The general practice was to pay time-and-a-half for hours worked in excess of 8 a day or 40 a week, subject to double time applying to hours worked on the second scheduled off day in a working week. In most cases the union contract specified the way in which overtime should be allocated to employees. Some contracts made provision for the employer to pay a penalty (attractively known as 'rocking-chair time') equal to the loss of earnings to any employee who was not offered any available overtime when it was his turn according to the rota.

Practices on week-end premiums, other than the overtime rate for unscheduled Saturday or Sunday working, varied quite considerably. In some cases Saturday ranked for no special premium at all, but any work on a Sunday, whether scheduled or unscheduled, attracted a premium. We also met the two extremes of (a) in one company no special premium for any Saturday or Sunday working, and (b) other cases where Saturday work and Sunday work both ranked for a special premium. With such widely differing practices, we find it difficult to deduce anything which we could call a standard situation. All we can say is that the maximum special week-end premiums we found were 50 cents an hour for Saturday working, and $1 an hour for Sunday working.

Shift differentials also varied quite considerably. A premium of 7 cents an hour (about 2½%) for all shift working, or alternatively no premium for morning shifts, 9 cents an hour (nearly 3%) for afternoon shifts and 18 cents an hour (approximately 6%) for night shifts, could probably be regarded as typical. We found few companies paying higher shift differentials than these, and we even found one or two cases where the shift differentials were even lower. It was the general practice for the union contract to specify the length of notice to be given to a man required to changed from one work schedule to another, and the penalty to be paid on failure to give the requisite notice was also specified. Typical of this penalty would be the requirement to pay the first shift worked on the new schedule at time-and-a-half.

Bearing in mind the long period for which wage rates were fixed by contract with the union, it was not surprising to find in one case, where the contract was for a period of three years, that there was provision for the calculation and payment of a cost of living increment.

In most cases we found that the work of wages calculation was handled very largely by computer. Wages were almost invariably paid by cheque, though in a few cases the system of direct transfer to the employee's bank account was gaining in popularity. This elimination of the need for counting notes and coin, coupled with the elimination of clerical work involved in incentive bonus schemes, had clearly resulted in a much reduced need for wages clerks.

Although we were unable to investigate the matter thoroughly we formed the impression in every area we visited that the rates of pay in the chemical firm compared favourably with those paid by other industries in the district.

3.35 Attitudes to shift-work and overtime

In general in America the men did not like working on shifts but they accepted that it was part of the job. This dislike of shift-work was often stated to be one of the incentives to men to bid for jobs on the maintenance side.

At one site a 'steady shift system' was in use, so that men were permanently assigned to one of the three shifts; this was disliked by management because they felt they were losing touch with the men who were not on the day shift.

The situation which we found with regard to overtime was different from what we had expected, both in regard to the extent of overtime working and the men's attitude to it.

The level of overtime working for hourly-paid men on both production and maintenance sides was generally between 10% and 12% and sometimes higher; the lowest figure we met was 6%. The managements did not like this situation and attributed it to having to run the plant flat out in order to meet the pressure of demand. The attitude to overtime among the men was virtually the same as in Britain, they were pleased to have the opportunity of earning the extra money, particularly the younger men. In one works, however, overtime was running at an excessive level and the men were beginning to object.

Two points which have been mentioned as affecting willingness to do overtime are 'moonlighting' (having a regular spare-time job) and pooled transport arrangements. We met these practices but were told that they had little effect on the attitude to overtime.

3.4 Comparison of industrial relations practices

3.41 Negotiating procedures

Central to the understanding of industrial relations and social affairs in the American chemical industry is the fact that there is no formal contact between the Management and the Trade Unions other than at works level.

The Manufacturing Chemists of America, unlike the Chemical Industries Association in Britain, is not carrying the responsibilities of an Employers' Association. The MCA does have a strong committee in the field of industrial relations but the service which it gives its membership, and we learned from several sources that it is a very good service, lies essentially in the provision of information and statistics obtained from various sources including the Department of Labour and the membership themselves. We understood that a similar situation obtained in Canada. Furthermore, there are a number of other associations covering different companies which are operating in the chemical field but are not primarily interested in chemicals, a situation which has arisen by the mergers and vertical integration which has tended to take place in America. The coverage of the MCA therefore seems somewhat less embracing than that of CIA.

The Headquarters of the Trade Unions in the same way do not directly participate in bargaining with the employers, but provide a comprehensive advice service through their district offices to the Presidents of the 'Locals', or union branches. It would probably be true to say that they go a little further than this in that they give a strong lead as to the fields in which American labour should seek improvements at any particular time.

In the case of the very large companies, there has been some pressure from the unions for bargaining rights with the headquarters of the company covering all their operations in the United States. Such proposals have not so far met with any acceptance. It was surprising to some of us to be told in the head office of one large company that they could not recall a representative of the trade union ever being in the building.

The second important point of difference between the situation in America and in Britain is the extent to which labour relations in all industry are circumscribed by the Federal Labor Laws and perhaps to a somewhat lesser extent by State Labor Laws. This is a very complex subject which it is not our purpose to deal fully with in this report. These Labor Laws, which started to become important during the administration of Franklin D Roosevelt, provide in considerable detail the framework within which the management of an individual works and the representatives of the shopfloor in that works must conduct their negotiations. They include complex definitions of unfair labour practices and provide courts at various levels to which disputes in the field of labour relations must be referred. The important thing from our purpose is that everything is directed towards the protection of the rights of the workpeople, not nationally for an industry, not even nationally for companies, but for individual establishments and factories.

From this, it will be seen that the local agreement has to be so drawn up that it includes not only all those matters which are negotiated in the United Kingdom now by the Chemical Industries Association and the trade unions negotiating bodies, but also those matters which are peculiar to the works concerned. The plant agreements have to be drawn up, having regard both to the Labor Laws, which may cover such things as minimum wage rates, and to the more recent legislation designed to prevent discrimination against people on the score of race or colour. They must also take account of local state conditions, which in some cases prohibit the inclusion of a clause to the effect that union membership is obligatory at the establishment and which often regulate the maximum number of hours permitted to be worked in any one week.

Hence we find that a large company having works in various parts of the United States is likely to have a somewhat different form of contract for each one and will have to negotiate with the representatives of the workpeople separately at each location.

The third important difference from British affairs is that in general it can be said that all the workpeople on the pay roll at any one works are likely to be members of one union quite regardless of whether they are general workers or craftsmen. We did come across one case where a small section—the hourly paid laboratory testers—had formed a splinter group which had affiliated itself to a different international union and we also heard of one works in the south where there were a number of such groups affiliated to several unions, but in this case the factory management was able to negotiate with the workers representatives as if they were all members of one body. We believe that both these situations were unusual and that the typical state of affairs is where all the workers are members of one union.

It is also possible that the workers may elect to form themselves into a local workers association for that factory alone, without deciding to affiliate themselves to any of the large international unions. In cases like this, and we met only one, it seemed to us that the local workers association was in the same position as a trade union so far as the law was concerned, but of course it did not enjoy the advantage of the service provided from the headquarters of the International.

From the above, it will be seen that the most important feature is the plant contract between the management and the workpeople. In the preparation of these contracts, the management will in general be represented by the works manager, assisted by his personnel manager, and a number of his senior staff, and the workers' side will consist of an elected president of the Local together with a number of other representatives all of whom are also elected by the workpeople.

The contracts may be of one, two or three years and once the bargain has been struck and the contract signed, both parties are bound by its provisions for its duration. Common among the provisions of such contracts is the prohibition of strikes and lock-outs; thus in view of the strong arm of the Federal and State Legislation, strikes and lock-outs during the existence of a contract are extremely rare. In other words, these plant bargains are not merely civil contracts. Their negotiation and subsequent enforcement falls within the scope of the American Federal Law and in certain cases State Law as well.

The plant contracts that we have had the opportunity of examining varied considerably in length, content and complexity. A list of some of the items which we have found covered in these contracts is given in Appendix D. In addition to the hourly wage rates, the procedure for promotion from one hourly paid job to another was usually described, emphasis being laid on the rights of seniority. Public holidays, the qualifications for annual leave and the privileges in this field to be earned with service were listed. There were several sections devoted to working conditions, dealing with such matters as working on public holidays, distribution of overtime, moving from day work to shift work and so forth. A large section to be found in all contracts had to do with what we should describe as fringe benefits. Such matters as sickness and accident pay, widows' benefit scheme, saving schemes, and education schemes were sometimes spelled out in considerable detail in the documents.

In addition to the above, the union contract would probably set out the situation which existed in the works with respect to flexibility or demarcation. It was usual for the contract to specify all the job titles for the particular works together with the appropriate current rate of pay for each and the results of the bargaining between management and workpeople on the extent to which flexibility and interchangeability among jobs was permitted.

Further, the contract would provide for the existence of a joint management/workpeople standing committee, known as the Grievance Committee, whose job it would be to interpret and enforce the meaning of the contract within the ambit of the labour law. It would also describe the series of steps through which grievances had to be taken, a system comparable to the rules governing British disputes procedures. It was usual for the frequency of the meetings of the Grievance Committee to be specified—weekly in large works, monthly in small—and also the time permitted for any one grievance to be held up at any stage.

It will be understood from the above that the agreements were not open ended. They were made for a specific period of time and after the end of that period they automatically lapsed. Almost immediately a contract is signed the two parties to it would commence consideration of the next contract. It was normally about three or four months before an agreement was due to terminate, that the parties started getting together to negotiate a new agreement. Notification was given to the local office of the Labor Court to the effect that the plant agreement was due to expire at a certain date in the future and that the parties were in the midst of re-negotiating. Meetings would start by taking place at weekly intervals but as the due date grew closer the frequency would be increased and the duration of the meetings tended to lengthen so that in the last week or so before the expiry of the existing contract, it was not uncommon to hear of meetings taking place daily and in some cases going on late into the evening.

In most cases, by a process of give and take, agreement is reached and a new contract is signed. If, however, the parties cannot settle their differences the conciliation services of the Federal Labor Courts start to operate in an endeavour to bring an agreement about. During our visits at more than one place we heard of situations where strikes had taken place, often of several weeks duration, after the expiry of one contract, before the parties could agree on the terms of a new one. From what we could gather, the climate of these negotiations was very much one of horse trading, with, for example, greater flexibility between craftsmen and general workers being conceded in exchange for improvements in security such as an improved pension or widows' benefit scheme. With all these agreements being drawn up separately, not only were their provisions very different with respect to conditions but also we learned that one company in an area of high wage rates might well be paying a dollar an hour extra for the same job vis-a-vis a works that it operated in an area of low wage rates.

Reverting to the operation of the Grievance Committee, whose duties and terms of reference were always closely prescribed in the contract, we found several cases in large factories where these committees were engaged in discussing grievances at various levels for several days in each week. The early stages of the grievances were usually settled, if possible, between the elected representative of the workpeople and the personnel department, but failure to agree almost always took the grievance into a higher plane in which senior members of management became involved. It was interesting to note that in one case, some attention had been given to the rules of evidence and in another it was impossible to introduce fresh arguments or fresh evidence at later stages of the negotiations.

In the ultimate, there was recourse to arbitration and the method by which the arbitrators were to be selected was also laid down in the union contract, often with provision for the arbitrator to be appointed by an outside body in the event of a failure to agree. An interesting variant on this was a situation where a list of seven arbitrators was included in the agreement and each side in turn had the opportunity of crossing one man off until there remained only one who was then allotted the task.

The grievance procedure covered all types of difficulties such as the interpretation of the exact meaning of the sick pay provisions, the allocation of overtime and questions of factory discipline, but the highest proportion of questions which had to be settled appeared to be in the field of transfers from one job to another and the flexibility between jobs. The definition of the degree of flexibility was often a matter of disagreement. It was in management's interest to increase flexibility as far as possible, but the workers in general felt that the management were often attempting to construe the wording to give themselves greater freedom than had in fact been conceded. The important point, however, is that the job of the Grievance Committee was essentially one of the interpretation of what had been agreed, and never one of seeking to vary the terms of an existing contract.

It is worthwhile mentioning in conclusion that the existence of the Grievance Committee provided an opportunity for two-way communication, at which management were able both to inform the workers representatives of their prospects and intentions and to learn the views of the work force on their implementation and results. Sometimes this appeared to be done at the same sessions as those at which the grievances were discussed, but in other cases the same body of people met in a somewhat different atmosphere for this purpose of communication. In one plant we visited there were in addition to this opportunities taken by the personnel manager for very informal and off the record discussions of matters which were still at the formative stage. It will be seen that this aspect of the Grievance Committee's function was in part what is done in this country through the Works Council or Works Joint Committee but we did not find in North America a single case of the existence of a works council where the membership on the workers side included men who were not union stewards.

In one large works we found that the president, six of the stewards, one member of the Job Assessment Panel and one member of an Employee Relation Committee (whose duties include sick visiting), nine in all, were paid by the company but fully employed on union affairs. In smaller works perhaps only the president would be operating in this way, and in the very small factories all members on the workers side were part-time. Meetings, of course, took place in the company's time in every case.

For the sake of the balance of this report we have had to deal very shortly with the American Labor Laws, the provisions for labour courts and the definitions of unfair labour practices, and we have only touched upon the relationships between the trade association and the management and between the headquarters and district organisations of the international trade unions and the workers side of the bargaining committee. Nevertheless we believe that these are important and must be taken into account in any study of manpower utilisation in America.

3.42 Identification of employees with company: company's local image

Under the American system of promotion by seniority an employee who has been with a company for several years has quite a lot to lose by leaving. Realisation of this fact, which links his fortunes with those of the company leads to his taking a keen interest in the management's performance. Another factor is the local negotiation of wage rates, on a works basis. Both workers and unions realised that it was easier to squeeze more money out of a company which was making good profits, and the union made it its business to keep an independent check on the fortunes of the company. We took the opportunity at every American works we visited of meeting and speaking separately to both management and stewards. As might be expected we heard in one or two places stories of arguments, battles and misinterpretations, as indeed we did in Britain. Even in the case where the stewards were most vehement, and almost bitter, they accepted that unless the company was making a good profit they would be wasting their time seeking to obtain better pay or conditions.

As a result of these circumstances the American worker was much more interested in his company and his workmates than in the chemical industry as a whole or the national union. This attitude was encouraged by management, aided by the better communications which existed between management and the shop-floor. Despite this greater identification of employees with their company, American workers fought just as keenly as their British counterparts for their share in the increased prosperity of the company.

Companies often made considerable efforts to project favourable images of themselves in the local community and encouraged their staffs to play a part in local affairs. In some areas, where the company was merely one of a number of industrial concerns, it was a struggle to make much impression, but it was clearly thought to be worthwhile. One company had spent a considerable sum on building an auditorium which would be made available to local organisations.

Most companies were very conscious of the desirability of communicating with the general public through their employees on such subjects as effluent, fume, noise and nuisance. These are subjects likely to rouse strong feelings, and the local people, if they are not kept fully informed, might well cause considerable difficulty for the company.

3.43 Fringe benefits

We found what appeared to be a slightly greater use of fringe benefits in the remuneration system for chemical workers in America than in Britain. Not only were there invariably pension schemes for all permanent employees, but also there were usually contributory group insurance schemes to cover such eventualities as sickness, accident, long term disability and death. However, we were aware that the lower level of national social security benefits in America was a contributory cause of this difference in fringe benefit levels, and this made it difficult to assess the significance of the difference in practice as far as remuneration of the employee was concerned.

One benefit which was generally on a more generous scale in America than in Britain was the annual holiday entitlement. It was not uncommon for this to vary with length of service from 2 weeks up to a maximum of 6 weeks after, say, 35 years service.

The general management attitude was that the existence of these fringe benefit schemes was not a very significant element contributing to the companies' ability to recruit and retain employees of the right quality in the right quantity. Nor was there much evidence that these schemes had been introduced as a matter of social conscience. Almost invariably the primary cause of the existence of these schemes was one of custom and practice in American industry; they existed because the supplementing of cash remuneration with participation in such social security schemes was an accepted general practice. In those cases where the level of benefit provided was above average, it was clear that the present level had been achieved through the normal process of negotiation in which the workers had made concessions on such things as flexibility in exchange for these improvements in remuneration. Fringe benefits have in recent years assumed greater importance in the contracts.

We did not feel that there was any new lesson for British managements to learn in this connection. Fringe benefits in America are not given, ex gratia, by the employers, but are matters for negotiation with the unions. As productivity bargaining develops in Britain fringe benefits are likely to play a greater part in the agreements.

3.44 Similarity of terms of employment: staff and payroll

We found that the normal situation in the USA was for the working week to be the same for staff and payroll. A typical system was for shift workers to work between 8 am and 4 pm (no formal break for lunch, which was fitted in if possible); day workers worked from 8 am to 4.30 pm with a half-hour break for lunch; staff worked from 8 am to 5 pm with a one-hour break for lunch. It was not unusual for the rules governing pension schemes to be the same for staff and payroll and similarly for such matters as holidays, stock option schemes and other fringe benefits to be based on length of service and not rank. Where there were differences between staff and payroll in these matters, the differences were considerably less marked than in this country and the trend was towards reduction or elimination of the differences.

In the Canadian company we visited, this similarity of treatment did not exist to the same extent.

We believe that the fact that staff and men started work at the same time had a direct effect on manpower utilisation.

The similarity of terms of employment which has been achieved must, we believe, have made some contribution towards eliminating the 'we and they' attitude and bridging the gulf between shop-floor and white collar workers.

3.45 Working conditions and welfare

Under this heading we have considered not only the work-related items such as environmental control, refreshments, first aid and medical facilities, but also the extramural provisions such as sports and social facilities. In this area, as in so many others, we have come to the conclusion that the objective approach of American managements results in a rather better deployment of material and human resources than in Great Britain.

As is only to be expected, the amount of attention paid to environmental conditions such as heating, lighting and ventilation, appeared to vary considerably in both countries. Nevertheless the best practices we saw were in America. We did not come across any case where this had been carried to a lavish extreme but we did, for instance, find control rooms where thought had been given in the design and layout to reducing the inherent distractions and unpleasantness of the environment. For instance, the control room operator of a highly instrumented plant making a foul-smelling substance which required routine testing from time to time, had, adjacent to his well laid out control room, a small testing bay which, although readily accessible, did not have any inter-communicating door through which the offensive fumes could penetrate into the area where the man spent most of his working day.

By and large, less money and manpower was devoted in America to the provision of meal and refreshment facilities. We saw no palatial canteens such as one occasionally sees in Britain, and indeed such cafeteria facilities as we saw, although of a perfectly acceptable standard, seemed small in relation to the numbers of people on the site. Where provided, they were normally used by both hourly-paid workers and salaried staff alike. Meal-breaks tended to be shorter than in Britain—normally half an hour for hourly-paid workers; some shift workers had no recognised meal breaks. The majority of hourly-paid workers brought packed lunches even when canteens were available and ate them in amenity areas close to their place of work. This might, for instance, be in a relatively clean corner of the maintenance work shop for maintenance workers, or in the control room itself for many process workers. Frequently these amenity areas were modestly equipped with cooking and washing facilities, and in some instances soft drink vending machines were located close by. Where the amenities provided were above average (*eg* stainless steel sink, simple electric cooker and small refrigerator) the result seemed to be that the men took special pride in maintaining high standards of appearance and hygiene.

Standards of toilet and changing facilities also varied quite considerably on both sides of the Atlantic. In both countries we saw some facilities which appeared to be barely adequate, whereas there were occasional instances where the standards in force were clearly well above those required for basic material needs. Where these high standards had been adopted, the motive had, by admission, been to promote good relations between management and the hourly-paid ranks. It was impossible to assess how effectively this investment had worked.

Size for size the American factories devoted more money and effort than their British counterparts to the provision of first aid and medical facilities. The general standard for a factory of 1,000 employees, for instance, would be one full-time medical practitioner assisted by a full-time staff of three or four nurses and medical secretaries. In the largest American factories we visited the standard of accommodation, equipment and staffing was most impressive. Many companies insisted upon a pre-engagement medical examination, and most encouraged all employees to submit to a routine annual medical check. All this was aimed at ensuring that people were employed on jobs for which they were physically well-equipped, and on preventing lost time due to avoidable sickness. First aid care of those suffering occupational injury was usually stated to be only a secondary purpose of the medical department. We obtained the impression that this philosophy was well accepted by the employees, that they recognised the benefit which it represented to them as individuals, and that they co-operated willingly in these efforts to keep them at the highest possible level of employability. Here again the lack of facilities such as those provided by the British National Health Service must be an important factor.

The area in which welfare expenditure appeared to be at a lower level in America than in Britain was the area which we would describe as the provision of extramural facilities. Admittedly the practice in Britain on this point varied enormously from one company to another, but we did see at least one example in this country where the effort expended by the employer in providing sports and social facilities was clearly very significant. In America, on the other hand, we saw no such example. We did see cases where the company was, as a part of its efforts to create a good image locally, donating significant sums towards the provision of social and educational facilities for the local community at large. We did not, however, come across a single instance where an American company was spending significant sums of money or effort on the provision of sports and social facilities for its own employees exclusively. Where such employees facilities were provided, they were on a comparatively small scale and, even so, appeared to be no better appreciated than those provided in this country. The general opinion of the American managements seemed to be summed up in the comment that 'they like us to take good care of them while they are at work and pay them well enough so that they can lead their own lives in the way they want to outside working hours.'

3.46 Safety

Although we found considerable attention being paid to safety in the British factories we visited, it seemed almost nothing by comparison with the American efforts. Over there safety propaganda was always in evidence. There were coloured posters, illuminated signs, hazard warnings at the entrances to buildings, banners proclaiming the local safety achievement record, and so on. The standard of safety equipment provided was generally very high, and works rules requiring its use were generally very strictly enforced. This was impressed upon us in one factory which we toured by car, where we were told that it was a firm company rule that we must fasten our safety belts to drive even for short distances within the works. Management were not exempt from this ruling, and were most careful to observe it. On another site, every one, however short his visit, was issued with a gas mask.

Quite apart from the propaganda, the safety training and safety auditing appeared to be generally better developed than in this country. It was normal for a significant part of the course of induction training for hourly-paid operators and foremen to be devoted specifically to safety matters. Ensuring that attention was paid to safety in the course of day-to-day work normally rested with line management, though it was usual for their efforts to be supported by small specialist advisory safety staff. The essence of this staff's work was normally to ensure the provision and maintenance of safety equipment, and to organise safety training but not to carry it out, for that was the responsibility of line management. At one works there were monthly meetings on the subject of safety. At these meetings a one-hour talk was given and this was repeated throughout the day so that every one at the works was able to attend.

What seemed to us to be the most effective device in maintaining safe working was the safety audit which we found being carried out on one of the locations we visited. Here it was a recognised part of the routine duty of every foreman to make a spot check, by observation and interview, of one of his subordinates each week. The results of this observation and interview were recorded by the foreman in a safety register, and were inspected periodically by the safety officer. Such safety audits were supplemented by inspections by teams from other areas and even other works, so that there was a cross-fertilisation of ideas and less chance of bad habits passing unnoticed.

In a variation on this theme which we encountered, each foreman was expected to observe every one of his men at work and to hold with him in his office a counselling interview of one hour's duration every month. It was stated that although safety was top of the agenda at these interviews, they were also most valuable as two-way channels of communication.

Other measures taken to emphasise the need for safe working included safety competitions between works areas. At one or two works we were told that the regular appraisal of a member of management would include consideration of the safety record of his department. All of these procedures contributed to the greater safety-consciousness of the American worker.

One important feature of the American emphasis on safety is that great attention is paid to safety at the design stage of new plant.

It is particularly difficult to produce reliable international comparisons of safety statistics because of the different definitions in use and the different bases of the calculations. There is also no doubt some scope for adopting a favourable interpretation of borderline cases, and this is probably tempting when there is pressure as a result of trying to appear in a good light. Much of this can of course be said of many kinds of statistic.

Definitions of lost time accidents differ between Britain and America. In Britain we count inability to do one's normal work, in America a man who is capable of doing an alternative job is not included in the lost time statistics. It was suggested to us that the effect of changing to the British system might be to increase American rates by a factor of five.

Severity rates are affected by the different methods of treatment of fatalities. Accident frequency rates varied tremendously from one plant to another (by a factor of more than 10), and even severity rates varied from 50 to 400 days lost per million man-hours.

It has been estimated, after making allowances for the differences between the two national systems of calculation, that the American accident frequency rate for the chemical industry is approximately one-third of the corresponding British figure. The rate for the best American company is roughly one-fifth of the American industry average, and therefore just over one fifteenth of the British average.

Over and above the statistical comparisons and the undoubted fact that it is highly desirable to reduce the numbers of deaths and injuries occurring in the chemical industry, there are several points which are worth making.

Safety matters are of common interest to men and management and they offer an opportunity for the two sides to meet, discuss and agree on measures to be taken. This is a considerable aid to friendly relations, and safety matters figure largely in the discussions of joint committees partly for this reason. Similarly communications on safety are found to offer opportunities for a frank exchange of views on a wide range of subjects not necessarily connected with safety matters. One of the management men we met pointed out that the argument that 'an accident saved is money saved' could be used to overcome any workers' doubts that management was genuinely interested in safety measures.

Another point which was made to us was that men do not give of their best when working unless they are convinced that management, from the chairman of the board to the foremen, are genuinely concerned about safety and prepared to see to it that the job that the men are doing is being done with the minimum of risk. Productivity is likely to rise considerably when men feel secure and protected from accidents.

3.47 Communications and consultation

Employer/employee communications was an area to which American managements appeared to devote more attention than their British counterparts. In most cases the main theme used to stimulate the employees' interest was that of safety and accidents.

It was normal for two parallel channels of communication between top management and hourly-paid workers to be used. The one channel, jealously guarded by the unions, was that of the union bargaining or grievance committee. The other channel, guarded equally jealously by the management, was that of direct communication by writing, by broadcasting or by word of mouth through the line of command. The media used were, in the main, the same as those commonly in use in Britain, though there were some different techniques in their application. For instance, works news sheets were fairly common but they tended to be issued more frequently than over here. Some of these news sheets were published weekly, and there was even one case where a single-page daily news hulletin was distributed in the canteen by lunchtime each day, giving news of a general nature but including such things as reports on accidents happening the previous day. Some use was made of notice boards, but this medium did not seem to be highly favoured. Some companies operated a deliberate policy of sending bulletins to the employees' home addresses, where information of possible interest to the employees' families was concerned. Most companies made the maximum possible use of face to face communication, either between foremen and small groups or between more senior managers and larger groups, when they had information of special importance to communicate to their employees. In one large works there was a functional department, headed by a graduate, devoted entirely to communication and giving advice on communication.

Among the more recent developments which we came across was the use of tape recorded telephone messages. There were two main variations on this theme. In one application it was the practice for the works manager, or some other identified senior official, to record a message which could be listened to by any employee picking up a telephone and dialling a certain number. The message might concern, for example, the progress of an accident casualty or the state of progress of running in a new plant. The other main application was to use recording tape on which an employee, by dialling a predetermined telephone number, could record grievances, ask questions, or make suggestions. If a question and answer were thought to be of general interest, they were published in the daily newsheet; otherwise a direct reply was given, if possible within 24 hours. We can see a possibility that some companies in the British chemical industry could save man-hours of communication time by adopting techniques of this type. Other techniques which we saw, such as the use of local radio and television broadcasting stations, were not translatable into British terms, and in any case were appropriate only to large companies dominating a given geographical area.

The type of information communicated to the employees followed a fairly common pattern. As has already been mentioned, the theme of safety was almost invariably prominent. There was also a liberal helping of personal news, such as births, marriages and deaths. In some cases the written communications included items of general social interest, such as weather reports, share prices, brief notes on new local and federal legislation, sporting events and so forth. Information concerning the company's objectives, plans and procedures occasionally featured in the written communications, but was normally communicated mainly through word of mouth. This type of information seemed invariably to be aimed at explaining to the employees what the company was trying to do, why it was trying to do it, and how it was trying to do it. We did encounter one most carefully prepared and widely circulated document in which management defined their hopes and aspirations, and set out their philosophy of employer/employee relationships to indicate the lines of action they would be likely to follow in certain situations.

The general attitude of the American managements seemed to be to disseminate as much information as would enable the employees to understand why they were being asked to do what they were being asked to do, but not to invite the employees to participate in the task of decision-making. The managements were clear as to their duty to take the decisions. Nevertheless, most of them were fully conscious of the need to create and preserve a spirit of partnership with the people they were managing. Communications were used to announce decisions, to explain and justify the decisions if necessary, and particularly to forewarn employees of probable future decisions having a bearing on their employment. This attitude was summed up by the comment of one manager, who explained 'we try to avoid surprises'. Another remark was 'what labour does not know hurts.'

Another significant feature was the care taken to see that communication within management was good. On several of the works we visited there were regular meetings of management to discuss problems which had arisen or might arise. These meetings might be in the firm's time or after normal working hours.

All the plants we visited in North America were union-organised, in that management/union contracts were in operation. In all of them there were regular organised meetings between management and workers' representatives through the normal machinery of the grievance committee. In the larger plants these occupied as many as 35 man-days a week of effort. They were not, however, joint consultation sessions in the sense of two-way communication sessions designed specifically to assist in the formulation or modification of management decisions. It was admitted that occasionally they produced a feed-back of opinion to management which resulted in modification of management attitudes, but this was by no means the primary purpose of the routine meetings. (This does not apply to the special meetings connected with re-negotiation of the union contract, referred to in Section 3.41, Negotiating procedures). The routine purposes were to forewarn the employees of impending changes, to agree procedures for dealing with circumstances not covered in the union contract, and to deal with grievances according to the procedure laid down in the union contract. Where the volume of business justified it, the grievance committee met at set intervals to discuss matters other than grievances. This seemed to be accepted as having the advantage of allowing general communications to be dealt with in a less emotional atmosphere than might obtain when grievances were being discussed.

We found no works councils or works joint committees as we know them in Britain, in which shop floor representatives are not necessarily shop stewards. All discussions between management and workers went through the channel of the grievance committee.

4 Statistics

(a) Comparison of overall production manning

For the purposes of this section, the term production workers is taken to cover process workers and those who manage them.

In the pairs of production processes we studied the ratio of output per man (staff and hourly-paid) among production workers varied between unity and 3.7 to 1 in favour of the American firms. In one exceptional case the ratio was nearly 14 to 1.

A considerable proportion of the difference in each case is due to the savings in manpower which the Americans are able to make as a result of their larger scale of production, in particular because of the use of larger units of production. We were, in most cases, able to allocate an approximate plant scale factor to each comparison. Adjusting for this factor we estimated that the ratio of output per production employee varied between unity and 1.85 to 1 in favour of the Americans.

Using as our weights the numbers of British employees in the particular processes studied we arrived at an average ratio of 2.1 to 1 in terms of output per production employee. Over these same processes the average scale factor was of the order of 1.7, so that output per production employee in the companies visited was about 25% higher than in the British firms for reasons other than scale of production unit.

This measure of the greater utilisation of production manpower by the Americans would, in fact, be increased still further if due allowance were made for two factors. First, the American process worker, in general, undertakes a certain amount of 'first aid' maintenance. We estimated the proportion of his time spent on this at about 8%. Second, there is a higher proportion of actual product testing carried out by the American process worker. In some cases all the 'in process' testing is done by the operator.

Here we may note that the overall ratio of production employees to those employed in control laboratories in the firms visited was 11:1 in America against 9:1 in Britain, that is, the British firms use proportionately about 20% more staff in the control laboratories in relation to the numbers of production workers employed. Allowing for the 2.1 ratio of output per production employee, we estimate that for a given output British firms employ about 2½ times the number of control laboratory staff used by the Americans. Time did not permit us to study this subject in detail and we are therefore not able to explain fully how these savings are produced. Both scale (the testing of larger batches) and the fact that operators do some of the testing will clearly play a part, but we do not believe that these two are the only factors involved.

(b) Comparison of overall manning on maintenance and utilities

Comparisons of manpower utilisation in the maintenance field are notoriously difficult, particularly when trying to make the comparisons in relation to specific plants and processes on a large site. We found it no easier than others to carry out our assignment in this field and the data with which we were supplied was probably less specific here than in other areas of our enquiries. Among the difficulties of making comparisons are the facts that a proportion of maintenance work is in a sense voluntary, since it is a policy decision whether to do it or not; also the introduction of labour-saving equipment on the production side, while saving a number of operators, increases the plant which has to be maintained.

One means by which to arrive at a useful comparison of maintenance manning, however, is to start from the more precise statistics we gathered for output per production worker and to relate these to the relative proportions of production and maintenance employees on the sites we visited. Overall we found that in the American companies the ratio of production employees to those in maintenance and utilities was 2.5 to 1, and in the British firms it was 2.3 to 1. (It may be noted that the ratio of production workers to skilled craftsmen, *etc* as shown by the annual Ministry of Labour enquiry into employment in the UK chemical and allied industries is 2.5 to 1. This suggests that our sample was not unrepresentative.)

There is thus a slightly higher proportion of maintenance to production employees in Britain. However, as stated above, the ratio of output per production employee was found by us to be 2.1 to 1 in favour of the American firms we visited, and our higher proportion of maintenance employees would increase this ratio to 2.3 to 1 as a measure of the comparative maintenance manning in relation to a given output of product.

In the case of maintenance workers the scale factor is not so significant as it is with production workers, that is to say, the maintenance requirement does not stay so nearly constant with increasing size of production unit. Some allowance for scale should be made however, and if we may accept that the factor lies somewhere between 1.7, which we derived for the production side, and unity, which implies no advantage in scale whatsoever, it would seem to be reasonable to take a value of 1.35. On this basis, the output per maintenance worker in America is estimated to be 1.7 times the corresponding British figure. It therefore appears that, even if we allow for the effect of using larger production units, the British companies use over 70% more maintenance employees in relation to a given output. One reason for this is undoubtedly the fact mentioned in the previous section, that in America 'first aid' maintenance is done by process workers.

The argument is sometimes put forward that the difference between British and American manpower utilisation in the maintenance field is due mainly to our system of employing 'mates'. In the firms we visited in Britain, however, the ratio of craftsmen to mates varied from 1.1 to 1 to nearly 14 to 1. The average ratio was 3.5 to 1. It is clear, therefore, that even if it were possible to dispense with the use of all of these mates, this would achieve only a proportion of the possible manpower savings on the maintenance side, albeit a very useful proportion. Practice regarding the employment and use of mates does, of course, vary considerably between the various sectors of the industry in Britain.

It is perhaps appropriate to mention here that in America there is a category of maintenance worker known generally as 'helpers'. These are in approximately the same ratio to craftsmen as are British mates to craftsmen, but there the similarity ends. The American helper is an adult trainee, who is expected to qualify as a craftsman, and there is no question but that he is fully employed and uses tools.

(c) Clerical and administrative employees

At each of the works sites we visited we tried to determine the proportion of employees whose work could be described as falling within the category of works administrative employees. This we were able to do, but data for further categorisation of this group was not available. However, we did gain certain impressions regarding the constitution of this group. For example, the relatively large size of orders for products in American companies should mean relatively fewer people to handle the smaller amount of paperwork involved for a given output. On the other hand we were definitely impressed by the extent to which direct line management were able to call on specialist services which must have employed a significantly large proportion of staff.

For the purpose of clarification we should mention that our definition of clerical and administrative workers does not include people in sales, customer technical services, research and development, or central engineering services.

We calculated the ratio of the numbers of clerical and administrative workers to total workers. For the American firms our figure was 0.14 and for the British firms it was 0.16. Thus in relation to the number of other workers, British firms appear to employ between 10% and 15% more clerical and administrative workers. Taking into account the difference between American and British output per head, we calculate that for a given output British firms employ 2.8 times as many workers in this category. If we allow for the scale effect on the production and maintenance sides, this ratio is reduced to 1.7.

In certain categories of clerical and administrative workers, the numbers employed will be related to the total number of employees (*eg* personnel department, wages clerks) and in others the numbers will be related to output, possibly adjusted to take account of the size of orders (*eg* sales department). Thus it is not possible, without far more detailed study and categorisation, to determine the blend of these measures of relative efficiency which gives the best overall index. But it is clear that British firms have scope for considerable saving here.

(d) Other employees

Employees other than those categories considered above, namely production, maintenance, and clerical and administrative, include principally men working in the fields of packaging and despatch, receipt of raw materials, and external transport. There are very marked differences between American and British practices in these fields, and these are reflected in the calculated percentages of 'other employees' to total employees. For America our figure is 1.1% and for Britain it is 10.1%.

In America very few men are employed on packaging and despatch at the works. This is partly because the order sizes enable goods to be sent out in bulk, partly because of the use where possible of mechanical handling equipment, partly because some of the products are despatched to area depots for packaging into smaller lots for local customers. The American companies visited employed very few or no men on external transport; in some cases shunting on the site was carried out by railway employees.

It is clear, therefore, that the numbers of other employees do not provide a measure of the efficiency with which American companies work as much as a measure of the work they can avoid doing. From a national point of view, transferring the work to other companies does not of itself increase efficiency; but there is great scope for making positive gains by eliminating some of the more time-consuming packaging of tiny orders and by increasing the efficiency of the necessary work on packaging and despatch. In fairness, it must be pointed out that a considerably higher proportion of British output is exported, and this undoubtedly complicates the packaging and despatch problem.

The ratio of other employees of British to American companies on the basis of the figures given above for percentage of other employees to all employees, is 9 to 1. In terms of output per head, the ratio is estimated to be about 24 to 1.

(e) Ratios of staff to hourly-paid workers

Figures were collected for the ratios of staff to hourly-paid workers, covering works functions only. That is, employees concerned with functions such as capital engineering, research and development, *etc*, were excluded.

No clear differences emerged here. The figure for American firms was 1 staff: 2.3 hourly-paid. That for the British firms was 1:2.1. Taken individually the ratios for American firms ranged from 1:1.5 to 1:4.7, the latter being somewhat exceptional in nature. The range for British firms was 1:1.8 to 1:3.5.

Mention is made elsewhere of the relatively smaller numbers employed in direct management in American companies and of the impressive support they received from other functions. We were unable to determine the proportionate staffing of direct and functional management, but the fact that there is no significant difference between our British and American ratios of staff to hourly-paid suggests that the Americans have been able to provide their excellent functional support by effective deployment of their forces rather than by an increased intake of staff.

(f) Comparative composition of total works employment

The following table shows the relative proportions of employees in certain categories associated with works functions. Non-works services such as capital engineering and research and development are shown as additional figures although they refer to employment on the sites visited.

Category (all employees in each case)	*% of total in works*	
	America	*Britain*
1 Production	57	48
2 Control laboratories	5	5
3 Maintenance and utilities	23	21
4 Works clerical and administration	14	16
5 Others (packaging, despatch, *etc*)	1	10
Total works	**100**	**100**
6 Non-works services (including capital engineering, research and development)	24	19
Total on Site	**124**	**119**

(g) Summary table

It is of interest to calculate, on the basis of the figures which we have collected and the assumptions mentioned above, how many men a typical American company would require to produce the same output as a theoretical British firm with 100 employees. The results of this calculation are shown below, on two bases. The first is that the American firm operates with British sizes of production units, and the second is that it uses American size units. In all other respects, including the sizes of total output, raw material purchases and orders for finished products the American firm is assumed to operate under typical American conditions.

Category	*Number of employees*		
	British firm	*American firm*	
		Using British size production units	*Using American size production units*
1 Production	48	39	22.5
2 Control laboratories	5	3.5	2
3 Maintenance and utilities	21	12	9
4 Works clerical and administration	16	9	6
5 Others (packaging, despatch *etc*)	10	0.5	0.5
	100	**64**	**40**

It would be foolish of us to suggest that these figures are completely accurate as they are based upon small samples of the chemical industries of America and Britain, and they are dependent upon the accuracy of our assumptions. We have however done our best to present a fair summary of our results and to explain the sort of assumption that has been necessary. In our view, the table above presents a reasonable picture of the results of the different manning conditions in the chemical industries here and in America.

From the table we can extract a rough measure of the potential for manpower saving in British chemical works operations:

Category	*Possible saving by changes in manning practices and by attention to factors other than size of plant units*		*Possible further saving by increasing size of plant units*	
	% of present total British manning	*% of present British manning in category*	*% of present total British manning*	*% of present British manning in category*
1 Production	9	19	16.5	34
2 Control laboratories	1.5	30	1.5	30
3 Maintenance and utilities	9	43	3	14
4 Works clerical and administration	7	44	3	19
5 Others (packing, despatch etc.)	9.5	95	—	—
	36		24	

We have been unable to isolate all the effects of scale of operations and thus to measure the savings achievable solely by applying American manning practices to British plant and market conditions.

The statistical evidence nevertheless supports our impression that changes in attitudes and practices could produce a very substantial manpower saving even without any change in the scale factors. This saving could well be as much as 20 per cent of the present numbers employed; alternatively it could take the form of a 25 per cent increase in output from the existing employee force. The changes required to achieve this greater efficiency are entirely within the control of the people involved in the British chemical industry and could all be effected within a relatively short time.

It will be noticed that, although the numerical reductions to be looked for in the areas of production, maintenance and works administration are similar (see first column of table), the potential savings expressed as percentages of employees in the various categories are greater for maintenance and works administration than for production (second column of table).

The greatest increase in the effectiveness of production personnel is likely to be obtained by adjusting the scale of individual plant units to a more economic level. Changes to reduce or eliminate this particular scale disadvantage are bound to be medium-term rather than short-term actions. When taken they, too, should save about 20 per cent of present total manpower.

Other factors of scale include size of total market, size of orders and size of unit despatches. They are not all under the control of the chemical industry itself. Improvement of manpower utilisation in respect of them is therefore likely to be a longer job. Even so it is worth noting that, if they could all be improved to levels comparable to those applying in the U.S.A., they could provide yet a further 20 per cent saving of the present employee force.

If all these changes could be made, the sum total of their effect would be that the present work force in the British chemical industry would be capable of handling two-and-a-half times the present output.

(h) Comparisons of national statistics

Although in our selection of firms and products we tried to avoid any bias, clearly with such a small sample of the chemical industry of each country it could be claimed that our findings are unrepresentative of the whole. However, it is interesting to compare whatever information is available on a national basis with our more restricted calculations to see whether it supports or conflicts with our case. National statistics on a comparative basis are somewhat scant but we give here some based mainly on the 1963 Census for each country.

For the purposes of comparison US financial statistics have been converted to pounds sterling on the basis of $2.80 = £1.

	USA*	UK**
Total employees	747,000	410,000
Total value added	£6,250 million	£952 million
Total payroll (all employees)	£1,790 million	£345 million (est.)
No of works with over 20 employees (UK—over 25 employees)	4,052	1,963***
Total capital investment 1955/65 (at current prices)	£6,320 million	£1,700 million (est.)
Average annual capital investment 1955/65	£575 million	£155 million (est.)

* Chemical and Allied Industries, Section 28.
** Chemical and Allied Industries less Mineral Oil Refining.
*** Ministry of Labour figure for 1961

From this table we see that value added per employee on the 1963 Census basis was as follows:

USA £8,350	UK £2,300	Ratio: 3.6 to 1

This ratio of 3.6 to 1 is considerably above the overall figure calculated from the summary table for our sample of the chemical industry, which is 2.5 to 1. If any conclusion can be drawn from this it is perhaps that our sample results do not exaggerate the differences in manning. It must however be remembered that the figures upon which the ratios are based are different in character in several respects. The national figures include all the workers in the industry whereas the sample figures exclude employees in non-works services (capital engineering, R. & D. *etc*). More importantly the national figures measure output in terms of value added, while the sample is based upon output expressed not in value but in volume.

Differences in wage and salary rates between America and Britain are sometimes used to discount the differences in manpower utilisation outlined above. Wage and salary costs will also affect the value added figure itself. If, however, we compare output (value added) per £1 of earnings the resulting figures should indicate the extent to which high labour costs in America offset the differences in output per employee. Further, we can include the effect of capital expenditure in our comparison.

	Output (value added) per £1 earnings (all employees)	*Output (value added) per £1 of earnings and average annual capital investment*
USA	£3.50	£2.64
UK	£2.76	£1.90
Ratio	1.3 to 1	1.4 to 1

It would appear from this table therefore that despite their high labour costs and their greater rate of capital investment, the Americans are 30-40% more productive.

It is of some interest to get an idea of the comparative make-up of the chemical industries of the two countries in relation to size of works, *etc*. This is indicated by the averages derived from the statistics given in this section. The figure may be out by about 5% because of exclusion of works with less than 20/25 employees, but they are reasonably valid.

	USA	UK
Value added per works	£1.54 million	£0.48 million
Employees per works	185	230
Capital investment per works*	£1.56 million	£0.87 million

(* Assuming plants more than 11 years old have been written off)

It appears therefore that with about 6 *times the total output* (as measured by value added), the Americans have about *twice the number of works* that we have with over 20/25 employees.

On average, each American works has only about 80% *of the numbers employed* in the average British works, but has nearly *twice as much capital* invested and *produces over three times as much.*

5 Conclusions and recommendations

We are convinced from our investigations and from the statistics we have collected that in relation to total output the British chemical industry employs something like three times as many men as the American chemical industry. The greater part of this difference is caused by factors which can be controlled. We give below our conclusions as to the major factors involved and the action which needs to be taken.

In the interests of improving the efficiency and competitiveness of the British chemical industry, we recommend that the Economic Development Committee, the trade associations and the trade unions should give the widest possible publicity to this report, and encourage all those concerned with the industry to act upon its recommendations. In particular, the Chemical Industries Association through its Area Productivity Committees should organise conferences to promote discussion of the report with a view to determining how best to produce the necessary changes in the industry.

Conclusion 1

The scale of operations is a major factor in the achievement of increased output per man in America. Of the many aspects of scale the size of the production unit is the most important.

Recommendations: British companies should consider what scope exists for optimising the size of production units. The EDC should examine the means by which the chemical industry might increase its scale of production by rationalisation.

Conclusion 2

American management is more effective. This is due principally to clear definition of the objectives, responsibility and authority at all levels. In pursuance of his objectives, each manager makes full use of specialist support. The delegation down the line of as much responsibility as possible increases the effectiveness of management at the lower levels.

Recommendation: British companies should critically examine their management structures to ensure that they are ideally designed to achieve their objectives. The CIA should provide an advisory service to assist in this.

Conclusion 3

Cost consciousness is a major factor in promoting greater efficiency in the utilisation of resources, including manpower, in the American chemical industry. American management, because of its cost- and profit-consciousness, is continually striving to improve manpower utilisation.

Recommendation: British companies must encourage cost-consciousness and train their management at all levels in the use of cost-control information. The essential service which cost accountants can provide in supplying relevant control information must be recognised. They must be required to provide the information promptly to the managers at the points of control.

Conclusion 4

There is more flexibility between the various trades and between tradesmen and operators in America. There are no mates. Trainees use tools on productive work. Line managers have greater control over manning. These matters contribute to greater effectiveness of the work-force.

Recommendations: British management should not be prepared to accept traditional systems of manning. Management and unions should work together to find means to fit manning to present-day requirements. Sound productivity agreements are one way to achieve this. The appropriate negotiating bodies in the chemical industry should examine how best to assist individual companies in these matters.

Conclusion 5

American training is more effective because it is more directly related to the work a man is expected to do. In addition there appear to be no barriers to training or re-training up to ages as high as 45, even in the craft field.

Recommendations: British companies should examine their training policies to decide whether they are adequate and sufficiently specific. British trade unions and management should together evolve training procedures, for all categories of workers, which are based not on traditional concepts of training but on the true needs of a constantly changing and developing technological industry. In anticipation of the creation of the Industrial Training Board dealing with the chemical industry, the CIA should set up a training committee, on which all unions concerned with the industry are represented, to prepare training programmes for submission to the Board.

Conclusion 6

The American system of plant contracts and of a single union's 'Local' acting on behalf of all the men at a given plant simplifies negotiations aimed at the introduction of changed working methods.

Recommendations: British trade unions and management should consider what aspects of the American system could with advantage be adapted for use in this country. The negotiating bodies dealing with the chemical industry should examine the balance between national and local agreements, and the possibility of creating, in appropriate situations, multi-union bargaining arrangements.

Conclusion 7

The American worker is better informed and more company-identified than his British counterpart, and this increases effectiveness. Management contributes to this situation by ensuring that communications are very good. The two main channels of communication are directly through line management and through the negotiating (grievance) committee. The Americans do not use separately created consultative bodies.

Recommendations: British management should take steps to improve communications in their companies not merely as regards means but also in regard to subject matter. Trade unions and management should examine their consultative procedures.

Conclusion 8

The American chemical industry offers career prospects within the ranks of hourly-paid workers. This situation is produced by the job promotion procedure allied with a large differential between the lowest and highest job rates of pay. This allows the industry in America to recruit applicants of higher educational standards than is the practice in the UK. Since they are not recruited for specific job vacancies, they include a significant proportion of school-leavers.

Recommendations: British management and trade unions should consider the ways in which hourly-paid workers can be given prospects of advancement which, coupled with the necessary training, will utilise their capabilities to the full, and the ways in which recruits, including school-leavers, with the appropriate educational standards can be attracted into the industry.

Conclusion 9

The greater attention which American companies and management devote to safety measures and publicity relating to safety reduces the number of accidents, helps to promote good relations between management and shop-floor, and produces a climate conducive to greater efficiency.

Recommendations: British management at the highest level should institute strong and effective safety policies and practices. These policies and practices should be rigorously applied by all levels of management. Trade unions must encourage their members to co-operate in the application of these safety policies. The British Chemical Industry Safety Council should examine American safety practices in detail so that they may jointly with the trade unions be able to assist management to these ends.

Conclusion 10

Incentive pay schemes are frequently irrelevant, uneconomic, and likely to introduce undesirable rigidity into working practices. The American companies we visited have in large measure abandoned them. They find that these schemes cause friction between management and men which outweighs any possible advantages. American workers generally dislike the fluctuation in take-home pay which is a feature of incentive schemes, and have usually been prepared to bargain with management on the replacement of such schemes by higher job rates.

Recommendation: British management and unions should consider whether existing incentive schemes are still relevant and effective.

Conclusion 11

The terms and conditions of employment in the American chemical industry do not erect a barrier between the staff and the hourly-paid. The hours of work and the principles upon which fringe benefits are based are usually the same for each group. Such differences as exist are fast disappearing.

Recommendation: In the development of collective bargaining, particularly when related to productivity improvements, British managements and trade unions should examine how and how quickly fringe benefits and terms of employment for salaried and hourly-paid workers may be brought into alignment.

Conclusion 12

American first line supervision is extremely effective. It consists entirely of foremen; there are no charge-hands or leading hands. Great care is taken in the selection and training of foremen, and this is coupled with a system of management organisation which delegates greater responsibility to all levels and provides assistance to foremen so that they are able to concentrate upon their essential duties.

Recommendation: Management in the British chemical industry should study the status and responsibility of first line supervision and assist them to play a more effective role in the industry.

Appendix A

Companies visited

In America and Canada

American Cyanamid Co, Wallingford, Connecticut
Borden Chemical Co, Fayetteville, North Carolina
Dow Chemical Co, Midland, Michigan
EI Du Pont de Nemours & Co, Wilmington, Delaware
Monsanto Co, East St Louis, Illinois
National Lead Co, New York, NY
Pittsburgh Plate Glass Co, New Martinsville, West Virginia
Shawinigan Chemicals Ltd, Varennes, Quebec

In Britain

Albright & Wilson (Mfg) Ltd, Oldbury, Birmingham
BIP Chemicals Ltd, Oldbury, Birmingham
Distrene Ltd, Sully, Nr Penarth, Glamorgan
Laporte Titanium Ltd, Stallinghorough, Lincolnshire
Murgatroyd's Salt and Chemical Co Ltd, Sandbach, Cheshire
Shell Chemicals UK Ltd, Carrington, Manchester
The Borden Chemical Co (UK) Ltd, North Baddesley, Nr Southampton

Appendix B

Processes studied

The processes studied included the manufacture of the following products:
1 Chlorine and caustic soda
2 Ethylene
3 Formaldehyde, u/f and p/f resins
4 Phosphoric acid
5 Resin moulding powders
6 Styrene and polystyrene
7 Titanium dioxide

Appendix C

Team members	
(Team leader) J K Bottomley	Production director, Albright & Wilson (Mfg) Ltd
(Team secretary) D Sirkett	National Economic Development Office
D Basnett	National industrial officer, General and Municipal Workers' Union
G Cole	National officer, Electrical Trades Union
P H M Sharrock	Works manager, Distillers, Chemicals and Plastics Ltd
W B Sheppard	Industrial relations officer, Ministry of Labour
R E Tallon	National organiser, Amalgamated Engineering Union
M Viviani	Work study and productivity officer, Chemical Industries Association
S M Whittingham	Works engineer, Imperial Smelting Corporation (NSC) Ltd
J C Williams	National secretary, Transport and General Workers Union
E W Wyatt	Manager, operational efficiency, Laporte Industries Ltd

Appendix D

Items covered in management/union contracts

(This list is not intended to be exhaustive, but merely to indicate the range and variety of subjects which may be found in management/union contracts in America)

Advance to skilled service (increments in pay)
Agreement, articles, scope, tenure
Call-in pay
Classification of employees
Condition of employment (union membership)
Contractors, use of
Death in family
Department lay-off
Disciplinary action
Equal pay for equal work
Excused absences
Fire and first aid squads
Five years' service increase
Good standing
Grievances and arbitration
Guaranteed minimum payment
Hospitalization
Hours of work
Initiation fees and dues
Irregular shifts
Job bidding limitations
Jury duty
Laws, compliance with federal and state
Lay-off benefits
Lay-off notice
Lay-off options (last in, first out)
Leave of absence
Loss of seniority
Lunch period, working through
Management rights
Medical examination or treatment
Medical surgical plan
Military service
New jobs or vacancies
No strike, no lockout
Overtime, calculation
Overtime, distribution
Paint spray gun premium
Physically incapable
Plant lay-off
Portal-to-portal claims
Posting of bulletins
Private sick leave plan
Probationary period
Public holidays, payment
Public holidays during vacation
Pyramiding or duplicating of payments (overtime on premium time working)
Rate change on change of job, disablement
Recognition of the union
Regular work not available
Relief workers
Reserved jobs (physically incapable)
Retirement annuity and life insurance plan
Revision of work schedules
Safety and health
Safety committee members
Safety shoes, contributory plan
Seniority and lay-offs
Seniority list supplied to union
Shift premium
Shift workers, overtime pay
Sick leave
Sick pay
Stewards, appointment of
Sunday pay

Temporary job
Transfers
Transportation department shift assignments
Transportation for overtime workers
Union responsibility
Union rights
Vacations
Wage rates
Wash-up time
Warning procedure (disciplinary)
Work clothing
Work week
Working conditions

Printed in England for Her Majesty's Stationery Office by McCorquodale, London
HM 1495. Dd. 132845. 4/67. K52. 3309
S.O. Code No. 70-944